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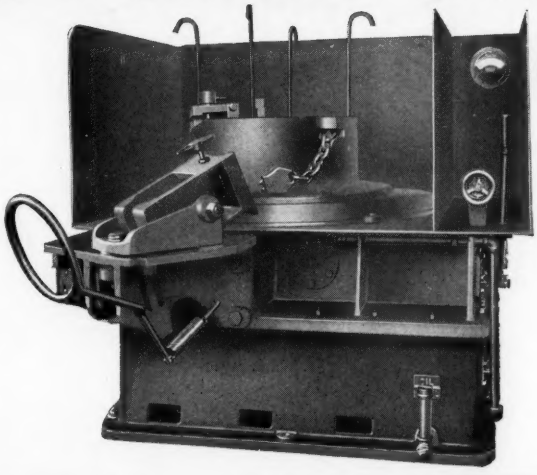

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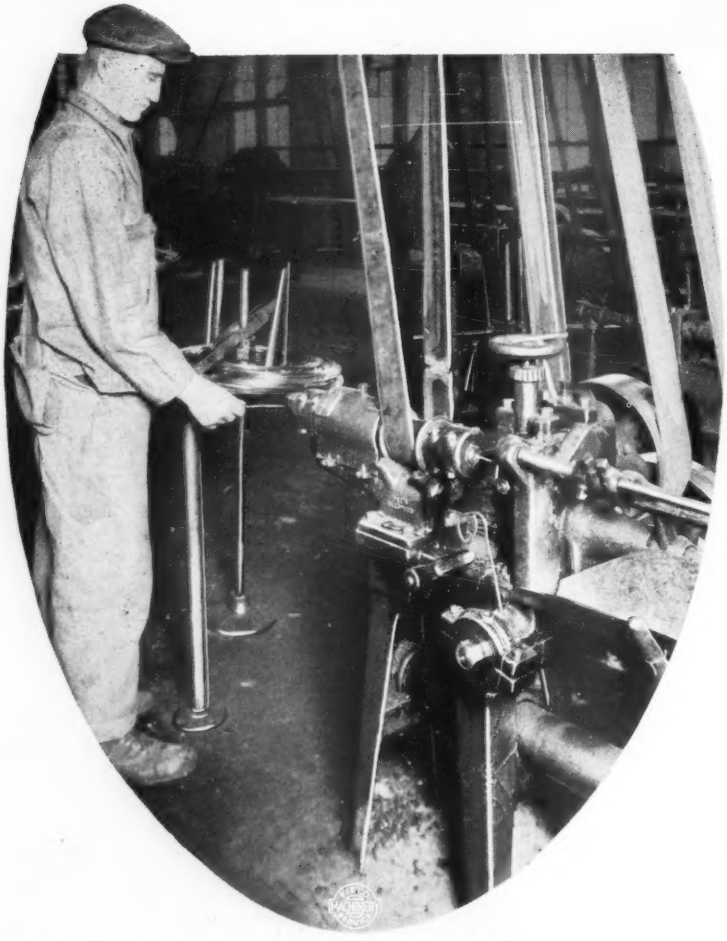

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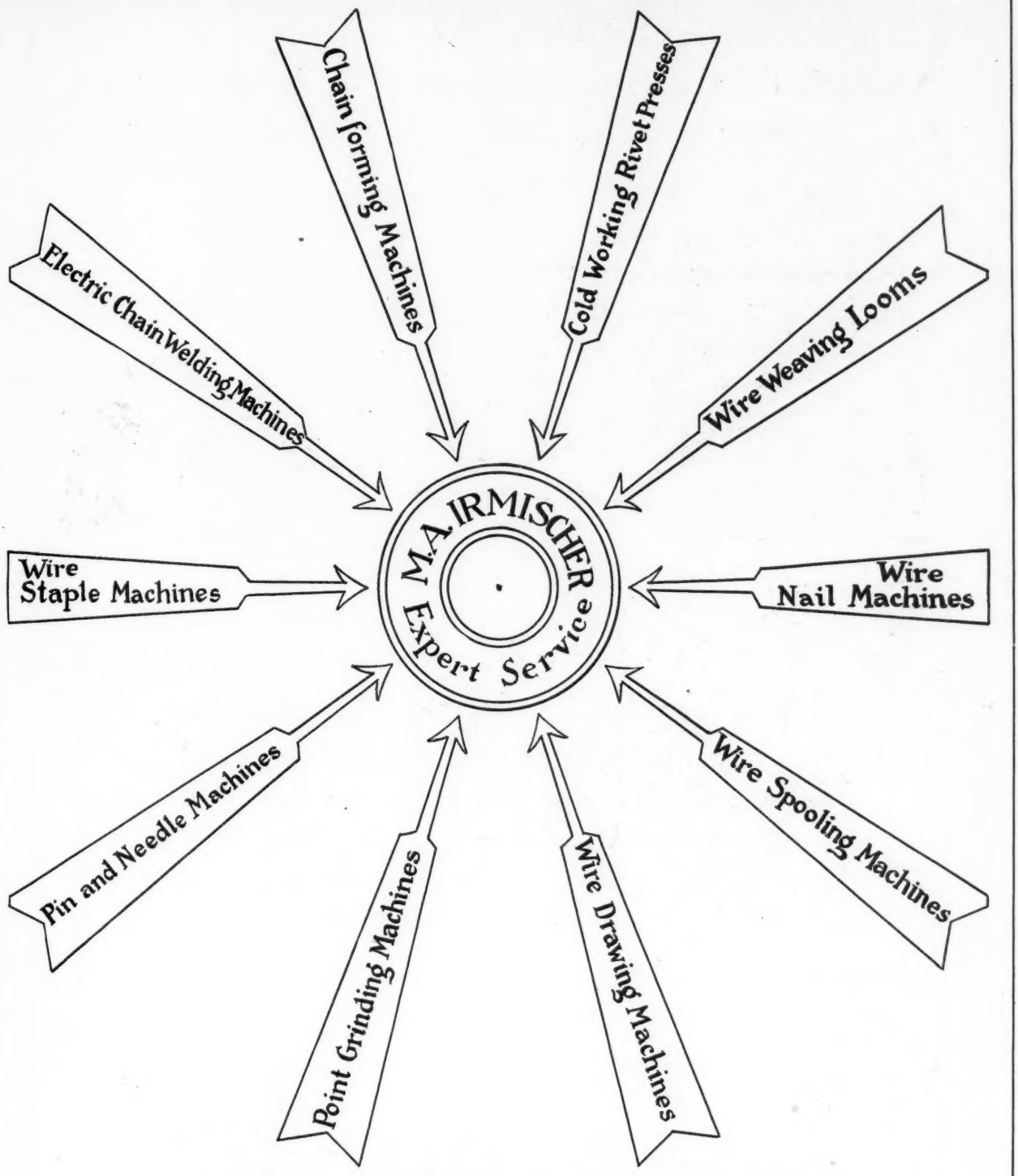

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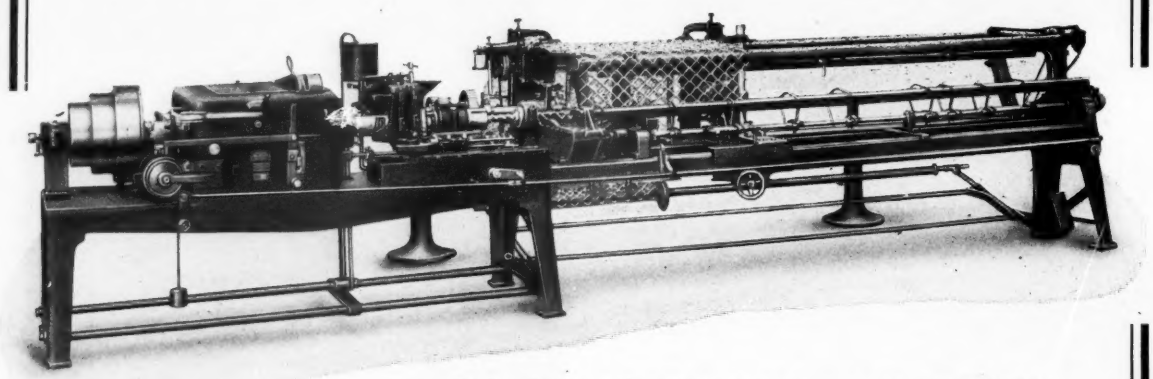

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WIRE & WIRE PRODUCTS

A monthly publication devoted to wire drawing and wire forming

Vol. 2 November, 1927 No. 11

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Editorial Offices:
471 Fourth Ave., New York City, Tel. Ashland 6280
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WIRE
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Vol. 2 NOVEMBER, 1927 No. 11

The Drawing of Profile and Shaped Wire

By J. D. Brunton

Bruntons Research Laboratories, Musselburg, Scotland

IN recent years where there have been endeavours to lighten machinery, heat treated alloy steel has been used; either a nickel or a chromium steel or a combination of both. The heat treatment of this steel has to be controlled by experts. The more complicated the alloy the more carefully has one to heat treat the steel, and the closer limits as regards temperature have to be observed. The disadvantage is that the heat treating of this alloy steel very frequently distorts it to such an extent that additional machine work has to be put on the piece after heat treatment. Further, the more complicated heat treatment of alloy steels increases the risk of irregularity and necessitates more careful inspection to ensure that every bar has been similarly treated.

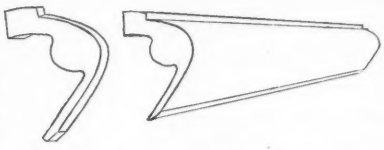


Fig. 1—Rocker arm produced by cold drawing.

It has been found in many instances that a straight carbon steel, when properly treated and subsequently cold worked to the correct degree, compares very favourably in physical properties with a heat-treated alloy steel, and fulfills entirely the requirements specified for a certain purpose. There is no doubt that a slight amount of cold working imparts a certain degree of hardness and toughness to a straight carbon steel, which makes it for many purposes just as suitable as heat treated alloy steels. The improved physical properties of the latter are due very largely to the fine grain, and a somewhat similar effect can be produced in properly heat treated and cold worked carbon steels.

When a cold worked carbon steel can be used, the initial cost of the raw material is considerably reduced, and this will, in many cases, compensate for the extra cost of making dies, and tools for the drawing of a special section. Where the engineering work is at all of the

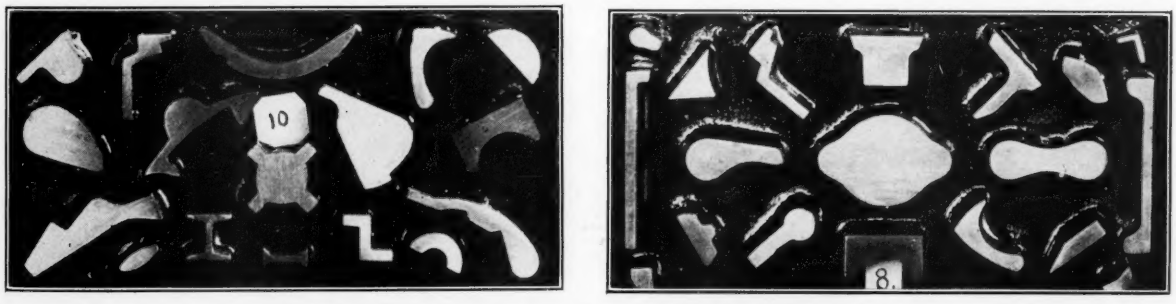


Fig. 2—Full size illustrations of profiled wire produced by cold drawing.

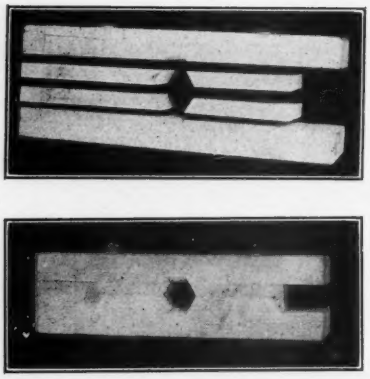


Fig 3 and 4—Showing split die for hexagon shaped wire. Lower figure shows die built up in position.

mass production type there is a distinct saving in many cases.

As a concrete instance where cold drawn shaped profile has proved considerably cheaper, we might take the rocker arm of a magneto. These were originally made from alloy steel, drop forged and heat treated, so as to give it the necessary strength. They were then milled, as a rule, in batches of 10. In some of the rocker arm sections used by the magneto makers there were actually over 30 settings in a milling machine before the arm was completed from the drop forging. Some of these settings had to be done on individual rocker arms. Now, this material is produced by cold drawing suitably treated carbon steel which gives the same physical tests and is, if anything, tougher than the alloy steel forging, the metal being more fibrous. The drawing is more accurate than the milling, and the total number of settings to finish the rocker arm from the bar of profile steel is only four. Below is an illustration of a rocker arm as produced in long bars of anything up to 20 feet.

It will therefore be seen that for mass production there is an undoubted saving in getting profiles drawn, and this method is being more and more adopted by engineers and designers than hitherto.

A number of sections are shown of actual profiles which have been produced. The illustration shows them full size. (Fig.2)

The drawing of these sections is a much more intricate and skilled operation than the drawing of round wire. To make the dies for these profiles the diemaker must know the quality of the steel he is going to draw, and from his experience judge as to the flow of the metal during the drawing process. He must study the bearing surface as well as the amount of reduction in relation to the tenacity of the material. He must also regulate the drafting, so that irregular shapes are produced in gradual stages, taking great care that the general cold flow is as nearly as possible uniform throughout the section. If such shaped wire were reduced too suddenly, one portion of a section might be over-drawn, while another was scarcely cold worked at all. If the bearing surface of the die be too great, the pull required to overcome the frictional forces set up may be above the yield point of the reduced section, and fracture will result instead of cold drawing.

In drawing shaped material it is most important to lubricate the metal in a very thorough manner. Unless this is done it will "seize" in the die and do much damage through scoring the surface of the die. A variety of different lubricants are used in drawing, and each manufacturer has his own idea of what constitutes a suitable lubricant. Some use olive oil soap; others use mixtures of tallow, heavy machinery oil and soap powder—these are thoroughly mixed and then heated and stirred, and the resulting lubricant is of a consistency which can be easily put on the bars. Sometimes liquid lubricants are used; the advantage of this is that arrangements can be made for a constant stream of lubricant being pumped on to the bar as it passes through the die. Rape oil is used for this purpose. The question of lubricant has a certain bearing upon the required finish of the cold drawn material. If a bright finish is required then liquid lubrication is to be preferred; if a brown finish, which acts as a certain protection against rust, is required, olive oil soap is best, since this soap burns on to the material with the heat and pressure generated when the bar is pulled through the die.

In cleaning, the operations involved are as described in my article in the October issue of Wire & Wire Products, with the exception that greater care must be taken to see that the metal is thoroughly cleaned, and a clear metallic surface is shown throughout the material.

Another point which has to be most carefully controlled in the production of profile shapes, is annealing. The metal must be homogeneous and of uniform hardness. It would be impossible to produce a satisfactory profile if the bars were hard and soft in places, because the flow of the metal would not then be uniform; any irregularity of hardness in the bar is readily detected either by use of the Brinell or Shore scleroscope tests.

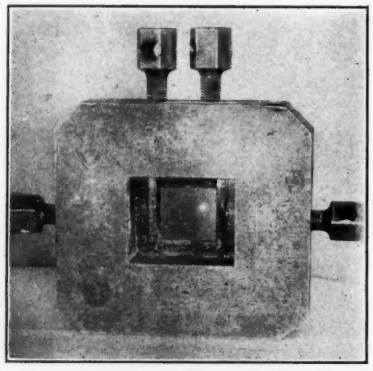


Fig. 5—Die box for holding split dies such as those shown in Fig. 4.

The necessary section for cold drawing is preferred by hot rolling. The rolling mill is put up against a furnace where the metal is heated to a uniform temperature. The heated bar is then rolled to a shape roughly resembling that of the finished section; this may necessitate 6 or 7 passes. The rolled shape has to be left in such a condition as to give the ultimate physical tests on the finished section, which is usually calculated by taking the chemical composition of the material and allowing for a certain percentage of reduction in area.

When the hot rolled bar or coil

has been produced, and it has been heat treated in the proper manner and cleaned, it is then ready for the cold work.

The dies used for intricate shapes are usually split dies; sometimes they are in two halves and in others made up of a number of parts. One of the simplest profiles to draw is the hexagon, and a very ingenious die has been devised for drawing this particular profile. A pattern of this die is illustrated in Figs. 3 and 4; first with the parts separated; second built up into position. It will be seen from the above that this die can be kept in perfect order simply by grinding. It has the advantage of being a simple die to make, as all the parts are rectangular. It also produces material with good sharp corners. The above is shown as an example of a die containing several parts. Split dies have to be contained in a die box. An illustration of a die box is shown in Fig. 5.

This is made of good cast steel, so that there is little or no elastic strength in it. It is important that these boxes are of ample design, otherwise split dies are very apt to spring while being used. This die box is carefully machined out so as to fit the dies to be used, and it is advisable to keep the outside dimensions of the dies similar, so that they can be utilized in a standard die box.

As an illustration of how the dies are shaped, we will take a specific section, and an illustration is given of the material as it comes from the hot rolls, partly cold drawn, and of the finished section. (Fig. 6)

The above section has been drawn in a two-piece die, as illustrated in Figs. 7 and 8.

These dies are made out of the very highest grade of cru-

Fig. 6—Shaped material as it comes from the hotrolls, partly cold drawn and finished.

cible cast steel, and after being milled approximately to the size required, they are finished with a smooth file to accurate dimensions. They are then hardened and tempered and worked up with emery powder and emery sticks to the dimensions required.

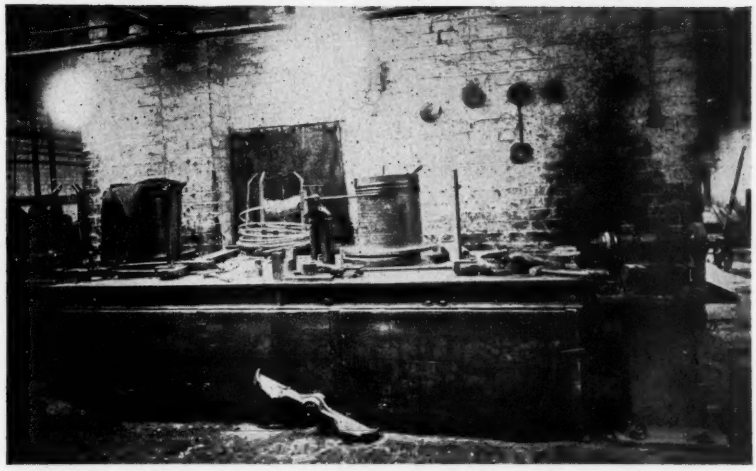


Fig. 10—Wire drawing block with "disappearing bearer" for drawing profiled wire.

In addition to the dies described, there is sometimes used what is known as a "Turk's head"; this device, which is illustrated, is a steel frame in which are supported rollers that act as dies. These rollers can be moved out or in so as to compensate for any wear there may be; they are made of hardened steel, and more intricate sets of rollers have been used for different shapes, but unless there is a steady run of any particular section the original cost of the rollers is excessive. (Fig. 9)

It might be mentioned here that there are two kinds of steel die plates used; one in the soft condition and the other in the hard condition. Each of them has its own particular favourable points. The hard die is made exactly to the required form and size, after which it is heated and quenched. To make this die hard it is necessary to heat it above the critical temperature, which causes the inner part to shrink, thus reducing the size of the hole below the required size. The die is then lapped out to secure the correct dimension; this is necessarily a very slow and costly process, but the hardened steel die will draw 40 or 50 times the amount of the soft steel die. In the soft steel die, the steel is just left in its soft condition, or, at the most, air hardened or normalized.

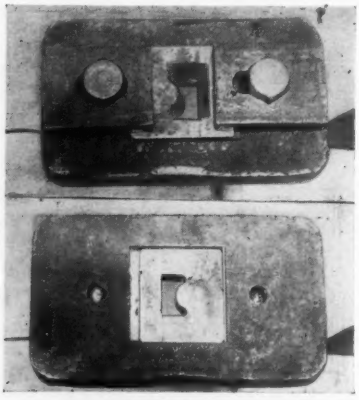
In drawing these accurate profiles, it is usual to finish them on a draw bench; that is to say, on a bench that draws them in a long straight length. But, before the actual finishing pass, if it is possible to draw them on a block in long lengths there is a considerable saving in many ways, and as, it is obvious, these special sections are unable to shoot up the block in the same way as round wire, there has been devised a wire-drawing block with what is known as "a disappearing bearer." The bearer holds the die and arrangements are made so that it can be lowered automatically at varying rates of speed. The block proper is always running at a constant speed, these bearers holding the dies are arranged to move, the exact width of the section being drawn, so that no one lap is on top of another. The section is started at the top of the block and gradually works to the bottom. An illustration of a block with a disappearing bearer is shown, also a drawing showing the mechanism of the bearer. (Fig. 10)

It is impossible to lay down any rules for drawing profile steel, as so much depends upon the actual section, quality of

material, and the ultimate physical tests asked for.

There are a number of smaller profiles made in solid dies—such as pinion wire; squares; hexagons; flats, etc.—and the making and punching of these dies has to be very accurately done, with the proper amount of taper to correspond with the quality of material to be handled.

It is not uncommon for the wire-drawer who draws these profiles to have specifications put before him tying him down to all dimensions being within 1/1000". In an intricate section this is somewhat exacting, and much more accurate than can be obtained by milling in the ordinary work-shop practice.



Figs. 7 and 8—A two piece die. The section shown in Fig. 6 was drawn on this die.

Where interchangeability is of importance there is no doubt that profile drawn material meets the requirements better than milled.

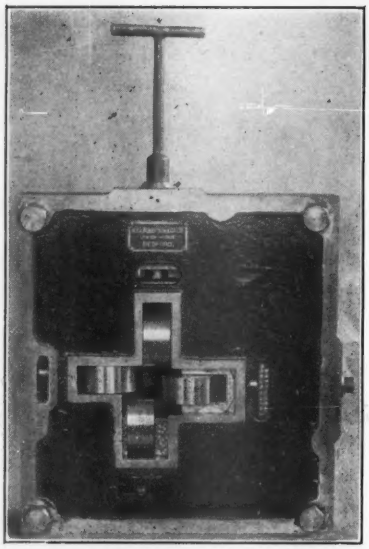


Fig. 9—"Turk's head" or roller dies. The rolls are adjustable to compensate for wear.

As can be seen, a book could be written on profile drawing, but each individual profile would have to be treated in a separate manner. The author's idea is to give a rough outline of the process, machinery, and dies generally used for the production of profiles; not to complicate the matter by giving detailed reduction of areas and tensile strengths of various steels which are used for various sections, but to give an idea to the designer that such material can be produced with great accuracy and at reasonable prices.

New British Wire Ropeway for Coal Transportation

THE British Railway and Canal Commission, presided over by Justice Sankey, has, after a second hearing, sanctioned the erection of an important aerial ropeway system from Tilmanstone Colliery, Kent, to Dover Harbor, for the transport of coal to the coast.

The first hearing occupied nine days last March, when the Court refused to sanction the scheme, holding that it was put forward without careful and complete consideration. Sir E. Tyndal Atkinson, K. C., then said that if a complete scheme were submitted it would receive the sanction of the Court. At the second hearing ten different State, manufacturing and commercial interests were represented by well-known counsel.

Justice Sankey said judgment would be given on the main issue, but it was subject to compliance with certain conditions. When the application was first before the Court the commissioners agreed that the proposed wire ropeway was in the national interest, but the scheme was incomplete in its inception and was based upon inaccurate and illusory plans. Therefore, the Court felt it would not be doing its duty if it sanctioned the scheme. Now the plans are entirely different.

The ropeway will pass over the land of 23 private persons, Government departments, companies, and corporations. Protective bridges are to be constructed, and apparently all the public authorities who control the roads are satisfied with regard to the safety of the persons passing beneath the ropeway.

The Tilmanstone Company alleged that the conduct of its business and the working of its minerals would be hampered if permission to construct the ropeway was not granted; also that the rates quoted by the railways for the conveyance of coal to Dover Harbor were excessive. The ropeway will provide a shorter means of transport and the colliery company says it will enable it to convey coal to Dover at an inclusive rate lower than that quoted by the Southern Railway, and to effect economy in and regularize its production. By railway it is eleven miles to Dover, and by the proposed ropeway only seven miles. It is urged by the applicants that the ropeway is of national importance, and that without it they would have to close down the colliery. From estimates put in it appears there is no economic alternative to the ropeway.

Before the coal strike the output of the Tilmanstone Colliery was 1,000 tons a day, but this will be doubled within three months of the erection of the ropeway and will eventually reach a maximum of 4,000 tons a day. Obviously, if this happens, there will be a corresponding increase of employment.

The total cost to be found by the colliery company is £93,000 ($465,000), and an undertaking has been given to provide that sum. Coal will be taken over the ropeway at one shilling (24 cents) per ton less than by the railway.

(*Continued on page 405*)

The Manufacture of Insulated Cables in France

PART III.

French practice in paper insulation, assembling, drying and impregnation

By George Kessler

(Translated from La Technique Modern by Samuel Rosch)

DURING the early stages of underground cable manufacture, insulating materials such as vulcanized rubber and sometimes gutta-percha were used, without any further covering being required as for example lead covering or armoring.

Vulcanized rubber was replaced by fibrous materials, especially jute impregnated with compounds consisting of a mixture of ceresin or rosin and petrolatum, the impregnated cable being surrounded by a lead sheath.

Up to 5,000 volts working

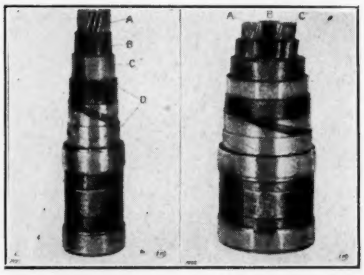


Fig. 1—Single conductor cable for energy distribution. A, conductor—B, insulation—C, lead sheath—D, armor.

Fig. 2—Three conductor cable for energy distribution. A. B. C. conductors.

service, impregnated jute gave excellent results, but for higher services, it was found necessary to resort to a more homogeneous insulating material, the one giving the best results being impregnated paper. It is to this type of cable manufacture that we will now confine ourselves.

From the preceding article we saw that no matter what the type of work a cable was intended for, the various methods of stranding differed very little from one another. If we take the case of a single conductor cable intended for direct current distribution (see fig. 1) we see that the essential elements are; the conductor proper, the conductor insulation, the lead sheath, and the armoring.

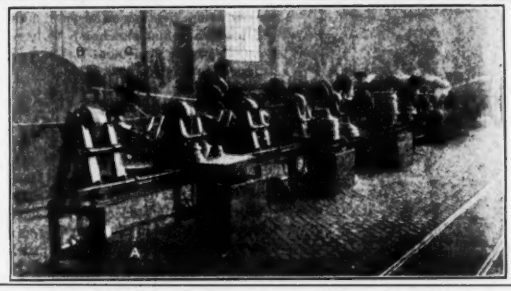


Fig. 5—Taping machine for insulating conductors, with layers in alternate direction. A, driving shaft—B, taping head—C, disc supporting taping heads.

If we take the case of a cable with several conductors, such as a three conductor cable intended for three-phase operation, (see fig. 2) we find the same constituents, the difference being that we now have three complete cables, each of which consists of a metallic conductor surrounded by its wall of insulation, after which the three insulated cables are stranded or cabled together into a circular core over which additional insulation is applied, the entire mass being placed under a common lead sheathing.

A method relatively little used to-day, consists in forming about the insulation of a single conductor cable, a layer or layers of strand concentric with the stranding of the inner conductor, the conductor thus formed being in turn insulated with a given wall of insulating material over which is provided a lead sheath (see fig. 3). This is known as a concentric cable.

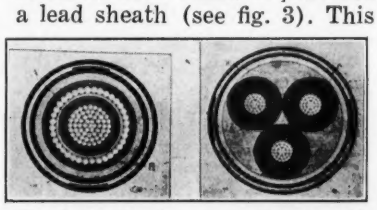


Fig. 3—Cross-section of a concentric cable. A, conductors—B, lead sheath.

Fig. 4—Cross-section of a cable with equipotential surfaces. A, lead sheath—B, fillers.

From the standpoint of cable calculations or design, the most important factor to be taken into consideration is the maximum potential gradient Gm this being the maximum value attained by the electrical field between the inner and outer conductors (in the case of a single conductor cable this field is between the conductor and the lead sheath). In a given cable, the gradient varies in intensity, inversely as the distance from the center of the cable, the maximum stress being at the surface of the conductor.

It is known, that in the case of a single conductor cable, the value of the maximum potential gradient is determined from the formula

$$G_m = \frac{V}{r} \times \frac{1}{\log_e \frac{D}{2r}}$$

where V=voltage between conductor and sheath
r=radius of the bare conductor
D=diameter over the insulated conductor.

In the case of three conductor cables however, the calculation is a little more complicated, the maximum gradient being determined by the formula

$$G_m = \frac{V}{(3r)^{\frac{1}{2}}} \times \frac{1}{\log_e 1.15 \frac{D}{2r}}$$

where V=voltage between phases.

Since Gm is a function of the diameter of the conductors for a given difference of potential between those conductors, if we maintain the diameter over the lead sheath constant, only varying the diameters of the conductors, Gm will become a minimum when

$$\frac{D}{2r} = 2.7 \text{ (minimum of the function } G_m[r] = \frac{1}{\log_e \frac{D}{2r}} \times \frac{V}{r} \text{)}$$

Therefore, whenever we have $\frac{D}{2r} = 2.7$

we have the most favorable operating conditions of the dielectric, since the maximum stress at the surface of the conductor is at a minimum. This condition is known as the value of maximum electrical efficiency of r.

This value of maximum efficiency has its importance, especially in the case of high tension cables where it is very often necessary to use conductors many times larger than would ordinarily be required for a given operating voltage. In the case of medium tension cables where a certain thickness of insulation is required for mechanical reasons, this value becomes of somewhat less importance.

From the foregoing, it follows that the thickness of the insulation will be largely determined by the value of the permissible gradient. In the case of three-phase cable, it is known that this gradient corresponds to the critical ionization voltage, in other words, that gradient at which the dielectric begins to change from a steady condition; the stress at which this condition arises, being between 3,000 to 3,500 volts per millimeter.

Fig. 7—Cabling machine with six bobbins of 1.200 m. diameter. A, bobbin carrying cage —B, filler supporting spindles—C, cage or barrel carrying taping heads.

For single conductor cables and for three-phase cables having equal potential surfaces this ionization voltage is much higher due to the better distribution of the dielectric field. Consequently, the potential gradient may be increased and in some cases the ionization voltages correspond to stresses between 4,000 to 4,500 volts/mm.

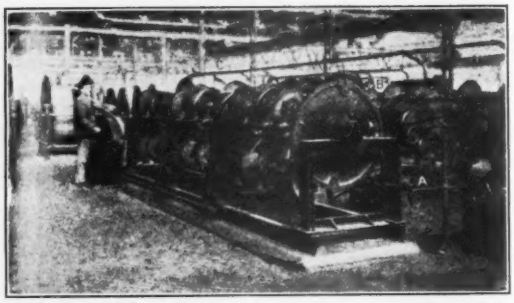


Fig. 6—Barrel type taping machine, for insulating conductors with layers in same direction. A, driving shaft — B, taping head—C, disc supporting taping heads.

Therefore if we calculate a cable in accordance with the given data, we see that if we take into consideration the factory test voltage and the probable surges that may occur during operating conditions, we should use a sufficient factor of safety during manufacture (say five or six) in order to produce a cable that will give satisfactory service. To achieve this, the insulation should be homogeneous, free from moisture and occluded air.

The material best adapted for this insulation is either wood pulp, or manila hemp as the case may be. The principal characteristics which the paper should possess are as follows: uniformity of thickness; must show a neutral reaction; and have long fibres. It must have high absorbing characteristics for petroleum or other greases, must contain no loading material, it should be capable of withstanding heat without excessive deterioration and should show a sufficient elasticity and tensile strength in both longitudinal and transverse directions. Both the drying and impregnating operations should be conducted with great care for the same reasons as previously stated, namely, homogenity, and the elimination of moisture and occluded gases.

Paper Insulating

The insulating of conductors with paper, can be accomplished in several different ways, since every manufacturer has a more or less preferred or secret method. Some use paper which has been previously dried and impregnated, while others apply it without having submitted the paper to any previous treatment. The paper is cut up into rolls having a width suitable to the diameter of the conductor to be covered, the number of layers used, being determined by the service voltage it is to be used for. The paper tapes can be applied either with a positive lap, a butt lap, or a negative butt lap. They can also be applied all in the same direction, or in alternate directions by series, as for example, three or four tapes may be wound in a right direction, then three or four in the reverse direction, the series of alternations being repeated every three or four papers.

Applying the paper tapes is accomplished by different machines, according to the particular method in use in that factory. When applying the tapes in alternate directions, an arrangement such as shown

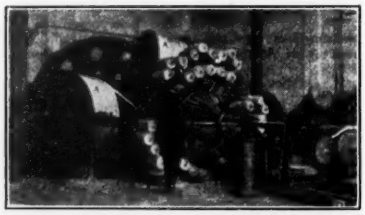


Fig. 8—Cabling machine with three bobbins of 1.890 m. diameter. A, bobbins—B, fillers.

in fig. 5 is used. Each disc of the machine, is driven alternately either right or left, with a certain number of taping heads mounted on each disc. When applying the paper tapes in the same direction, the same machine as shown in fig. 5 can be used with a small mechanical change, or a machine of the barrel or cage type can be used, as illustrated in fig. 6 where the tapes are all applied in the same direction. A machine consisting of two such barrel type machines combined as one unit, can be used to apply from 140 to 150 papers at one time.

When individual conductors are being insulated for the purpose of cabling them into a multiconductor cable, each conductor may be given a distinguishing mark by applying as the last or outermost tape, a paper of a different color, each conductor having a different distinguishing marker tape. This is done to enable the identification of the individual conductors during the testing and jointing operations.

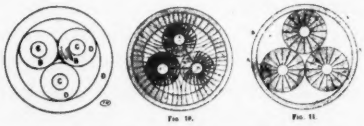


Fig. 9—Three-phase cable showing path of charring (according to Atkinson) B, charring —C, conductors—D, insulation.
Fig. 10—Cross-section of normal three-phase cable showing cooling lines. A. B. C. conductors.
Fig. 11—Cross-section of a three-phase cable with equi-potential surfaces, showing cooling lines. A, metal tape—B, filler.

Assembling or Cabling

Let us take the case of a three- conductor cable intended for three-phase work. Each of the conductors has been insulated with a given number of layers of paper calculated to give the desired radial thickness and in addition, the top paper of each conductor has a distinctive color. The individual conductors are then stranded or cabled together into a composite multiconductor cable having a uniformly circular cross-section. The void in the center and the outer voids located between each of the conductors, are filled with either twisted paper or highly compressed jute. The cable thus formed is once more insulated with paper tapes to the same radial thickness as that previously applied to the individual conductors (fig. 7). In this manner we obtain the normal three-phase cable, such as we have been using up to now.

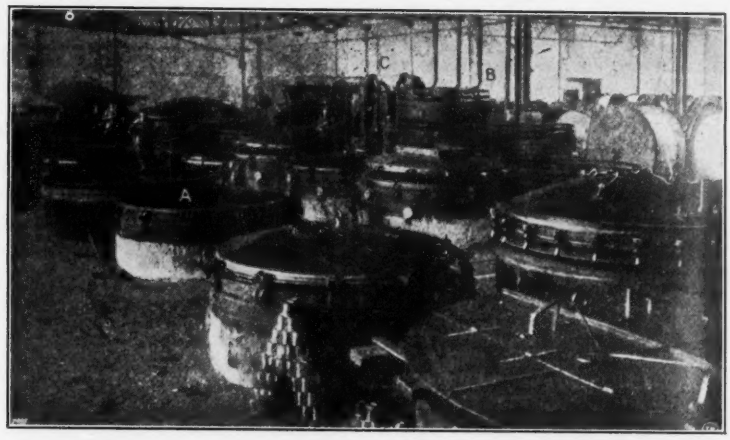


Fig. 12—Drying and impregnating installation. A, impregnating tank—B, cable pan—C, vacuum pumps and condensers.

The cabling machine shown in fig. 7, is an ordinary cable twisting machine, generally furnished with six bobbins with diameters varying according to the type of work from 0.8 to 1.8 meters. Three of the bobbins are used for the conductors while the other three are used for the fillers. A paper taping machine of the barrel type, is placed between the cabling head and the capstan of the machine.

These machines are also made with the bobbins to be used for conductors only, in order to make three or four conductor cables, the fillers being mounted in the front of the machines as shown in fig. 8.

We have just seen that for the normal three-phase cable, we apply over the assembled conductors, the same thickness of insulation, as we did on the individual conductors themselves. We can however, make a three-phase cable or for that matter any polyphase cable without adding this supplementary wall of insulation. This last form, depends upon a knowledge of some theoretical principles.

It can be shown that in a normal three-phase cable the electrostatic field is a rotary elliptical field continually varying in direction, so that at any given moment of the cycle, it may either be parallel or oblique to the layers of paper. This is a serious drawback from the point of view of the longevity of the cable, especially in the case of high-tension cables.

As a matter of fact, when the potential gradient of the occluded air pockets reaches a certain value, depending upon the size of the air voids, the temperature and the pressure, ionization phenomena is produced.

(*Continued on page 403*)

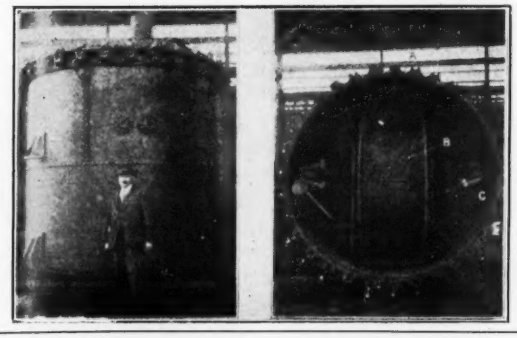


Fig. 13—Impregnating tank for drums of 2.75 m. diameter. A. impregnating tank —B. cable drum—C means for rotating drum.

Patent Pools and

Difficulties arising from confusion social value of patent interchange— rights—Decisions dealing with com

By David L. Podell
(Formerly special assistants to the

The authors of this article have made an exhausive study of the question of patent interchange and its relation to anti-trust laws. In the present discussion they present the legal and important industrial bearings of these problems. It is needless to emphasize the extent to which the wire industry as well as other industries should be interested in these considerations. It is to be hoped that our readers will not hesitate to communicate their comments to to us.

THE policy of encouragement to inventors, embodied in the Constitution and the patent laws, becomes especially significant in this age of endless discovery. It would be difficult to find an industrial unit of the first magnitude which has not imbedded somewhere in its structure the product of inventive genius protected by a patent. The issuance of a large number of inter-related patents and their distribution among various independent owners in the same industry, have presented forcibly the necessity of patent co-operation. An inquiry into the legal status of co-operative interchange presents the problem of the extent to which the rights acquired under the patent laws run parallel to or conflict with the liabilities, both civil and criminal, arising from a violation of the anti-trust laws.

Patent—, and Anti-Trust Laws Conflict

In the annual report of the Attorneys General of the United States for the years 1924 and 1925 the application of the Sherman Law to the acquisition and pooling of patents is noted as one of the major problems of anti-trust enforcement. It "involves the application of the anti-trust law to restraints of trade based upon the acquisition or pooling of competitive patents. The anti-trust law and the patent law have different and to some extent conflicting purposes." "Combinations by means of cross-licenses under patents are now frequently encountered."

It is to be observed, at the outset, that the Supreme Court in formulating the policy of the law, has taken occasion in one important line of cases, first to announce one rule of law, and then to reverse its former judgment by adopting what had been the dissenting view. This was done, furthermore, over the protest of some of the Justices, in whose opinion the law had acquired the attributes of a rule of property. Of the entire field it has been stated by an analytical writer that "few problems have given rise to more confusing diversity of judical opinion."

This has been reflected in the throughtful and instructive commentaries which the controversy has invoked.

The Supreme Court in the recent unanimous decision in U. S. v. General Electric Co. took the opportunity to restate certain aspects of the law. That may well furnish a convenient starting point. We shall consider first what are the established rights of the individual patentee, and then pass to a consideration of the legal consequences of a combination of patentees.

Rights of Patentee

The rights acquired by a patentee find their origin in section 4884 of the Revised Statutes, which is an exercise by Congress of the power conferred upon the federal government to enact legislation encouraging invention.

As early as 1852, in the case of Bloomer v. McQuewan et al., Chief Justice Taney had defined the rights of the patentee, in the following words:

"The franchise which the patent grants consists altogether in the right to exclude everyone from making, using, or vending the patented article, without the permission of the patentee. This is all he obtains by the patent."

The patentee, if he chooses, may withold his invention from the public, or he may waive, by license, his right to exclude, in which event, he may lawfully prescribe the price for the use of the patent, and attach such other reasonable conditions as are within the protection of the patent law.

An exhaustive presentation of the legal issue dealing with the various questions relating to the pooling and acquisition of competitive patents is like the piecing together of a mosaic. As the law stands today, we can merely search to the fundamental rationale of the decisions rather than point to any authority on all fours with the issue to be determined.

Difficulties Arising From Confusion of Terms

By the "pooling of patents," we shall rather refer to the co-operative interchange of patent rights, centralized pursuant to an agreement, including the covenants and restrictions with which one can find them usually accompanied. This would include, therefore, cross-licensing agreements, whereby non-exclusive reciprocal licenses are granted to each of the members interchanging patent rights. The right to bring an action against infringers for the violation of the exclusive right of the patentee to manufacture, use, and sell, is in this way waived pro tanto, by agreement. By means of reciprocal privileges, mutu-

*Reprinted from Amer. Bar Ass'n Journal, Aug. 1927.

Anti-Trust Laws

of terms—industrial and Anti-trust laws and patent bination of patent rights*

and B. S. Kirsh
United States Attorney in New York)

ally granted, the licensee gains by agreement, what the patent law otherwise prohibits.

Confusion arises from the difference between the lawful monopoly granted by the patent law and the illegal monopoly resulting from the unified power exercised to exclude competitors. This distinction was pointed out by the Supreme Court in National Cotton Oil v. Texas, and has likewise been the subject of notable historical reviews.

The interchange of patent rights has assumed various forms of which we need merely mention the most usual: The respective patentees may retain title to their patents and simply exchange reciprocal licenses to use their patents; they may transfer their patents to a trustee and retain a varying measure of control over the distribution of licenses; they may transfer their patents to a new corporation to whose officers is granted the power to issue licenses upon the terms agreed upon prior to incorporation; they may grant reciprocal powers of attorney to a common agency, which is authorized to distribute the licenses in accordance with an agreed plan.

Industrial and Social Value of Patent Interchange

No discussion of the legal questions involved can be thoroughly understood without some knowledge of the value to business and society of the cooperative interchange of patent rights. From the experience of American industry, a mass of information lies available to the student of the subject. This is evident, by reference to the cross-licensing arrangements in the automobile and aircraft industries, and the recent resolution of the National Electrical Manufacturers' Association.

One of the underlying reasons for the formation of an interchange of patent rights lies in the practical necessity to adjust infringement litigation where there is a claim of overlapping patents. No royalties, however great, would suffice to pay the tribute which protracted and costly patent litigation exacts. An inflated selling price of the commodity ensues. There is a shift, by incidence, of the price of litigation to consumer. It is, therefore, but prudent and economical business policy to compromise what otherwise would entail enormous expenditures and lead to a diminution of sales.

An elaborate index to all past numbers of

Wire & Wire Products

will be incorporated in the forthcoming

WIRE & WIRE PRODUCTS DIRECTORY, INDEX AND BUYERS' GUIDE

Fear of infringement suits, injunctions, and decrees for heavy damages, has dissuaded manufacturers from making expenditures to improve their plants and has resulted in enhancement of prices to secure them against the risk of operation under doubtful patents. Thus it has been said with reference to the cross-licensing agreement in the aircraft industry, that it is

"A practical business arrangement to do away with litigation over patents *and permit the members to build planes rather than try lawsuits against each other.*" (Italics ours.)

Moreover, a practical consideration arising from our heavily burdened court calendars is, that the original trial of a patent suit is not generally reached, in many districts, before two years, and that before a final adjudication can be reached, some four or seven years may elapse, if both parties insist upon exhausting their remedies.

Even the payment of royalties under a cross-licensing agreement becomes, therefore, an economically sound business arrangement whereby, in effect, an insurance policy is taken out as security from attack, at a cost known in advance.

Cross Licensing Raises Standard of Product

From a purely economic viewpoint, a mere dedication of reciprocal non-exclusive licenses can be subjected to no reasonable criticism. The industry at large, which is judged by the output of its entire production gains the direct benefits. There is an increased good will arising from greater confidence in the minds of consumers. Therefore, every product can embody the latest and most approved engineering ideas, and still retain for each manufacturer individuality of design, which is his distinguishing selling feature. The raising of standards follows as a natural consequence.

Another important advantage of cross-licensing is in its value to each individual party to the agreement, in securing for himself the results of a large volume of development-research and the accumulated practical experience embodied in the patents of his cross-licensees. A company putting in five patents may acquire the use of 125 in return, an advantage far outweighing the exploitation of its own inventions.

It has been demonstrated by the recorded experience in the automobile industry, that such

(*Continued on page 397*)

Important Factors in Wire Drawing

Influence of drawing speed, reduction and other factors on steel wire

By J. D. Brunton

Bruntons Research Lab. Musselbergh, Scotland

In drawing round wire uniform flow throughout the entire cross section is essential. Should the wire not flow evenly, owing to some lack of homogeneity in the metal, internal rupture tends to take place. Sometimes the core of the wire is hard and brittle while the outer layers are soft and plastic, and the external

Fig. 1—"Cuppiness" in wire due to excessive decarburization.

flow is much greater than the internal; this results in a state of excessive internal strain, which may develop into actual fracture. This is one of the commonest defects that one comes across in round wire, and is very often due to axial segregation in the ingot, but sometimes to a faulty contour of the hole in the die. Excessive decarburization also causes uneven flow, which develops "cuppiness" in the wire, but slight decarburization is often beneficial, because it gives the wire a soft skin which yields easily and decreases the friction between the die and the wire. If a longitudinal section of "cuppy" wire is taken, a series of small shaped fractures are often seen, called "herring bones."

Fig. 1 shows a photomicrograph of such a fracture.

This cuppiness, although it may be revealed by fracture during drawing, of course, makes the wire quite brittle.

Reduction In Area

It will, of course, be obvious that wire must be reduced in fairly gradual stages at each pass through the dies. The actual extent of this reduction in any one pass, when expressed as percentage reduction in area, has a definite relation to the work done. Reduction stated in terms of diameter does not give a true idea of the cold work involved. For example, the reduction of a bar originally 1 inch in diameter by 1/16 of an inch involves very much less cold work per unit volume than a reduction of 1/16 of an inch on a rod originally ¼ inch diameter, the reductions in area in the above cases being 12 per cent and 44 per cent, respectively. This fact has been taken into consideration in the construction of the various wire gauge systems. Although wire is not necessarily reduced one gauge at each pass, the wire gauge system affords a basis for measuring the reductions. Thus mild steel wire may be reduced in the initial pass from 5 gauge rod to 7 or even 8 gauge wire, the subsequent reductions generally becoming gradually lighter until in the final passes the wire will probably be reduced only one gauge at a time. Hard steel wire is reduced in lighter draughts and the physical properties of the finished wire may be controlled to some extent by the reduction per pass. If, on the one hand, a very hard and springy wire is desired in which ductility is of minor importance, heavy holing would then be adopted, while, on the other hand, a tough or ductile wire with less resilience is best produced by light holing. Of two wires receiving the same total reduction, one in light passes and many of them, the other in heavy passes and few of them, the former will have a lower tensile strength than the latter but it will be on the whole the better wire.

In American practice, particularly in large mills where the wire-drawers are running the same stock for long periods on a regular drafting program an increase of 1000 pounds per square inch per each 1 per cent reduction in area is taken as a rough estimate of the increase in tenacity, but it cannot serve in a mill dealing with many different grades of wire daily.

Drawing Speeds

The speed at which steel can be drawn varies with the dia-

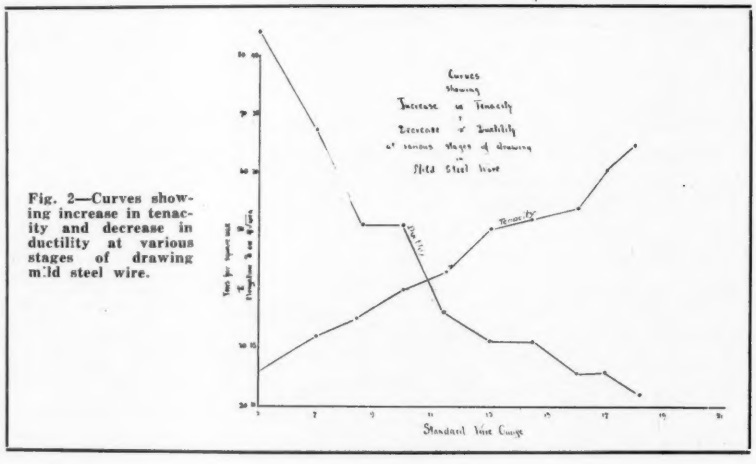


Fig. 2—Curves showing increase in tenacity and decrease in ductility at various stages of drawing mild steel wire.

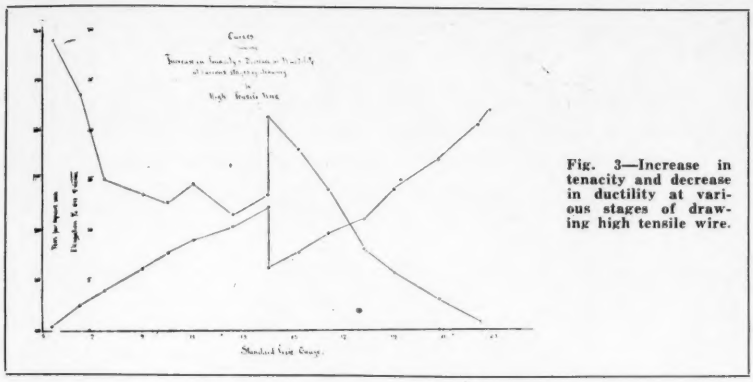


Fig. 3—Increase in tenacity and decrease in ductility at various stages of drawing high tensile wire.

meter or area and the quality of material. The author has found these speeds vary considerably in various mills, even with a similar quality of material. In very large sizes, where the material is being drawn on a rack, the average speeds are as follows:

From 3½" down to 2", 8 ft. per minute.

From 2" down to 1" 16 ft. per minute.

From 1" down to ½" 22 ft. per minute.

In drawing flat bars, hexagons and other profiles, it is usual to reduce the speed 25% for the same area, owing to the extra friction and also to allow the material to flow into the sharp corners so as to produce a sharp edged bar.

As regards speed of drawing there are fairly large working limits depending on the machines available. A good average speed for patent steel wire is 250 feet per minute and for mild steel 400 feet per minute. Some figures given by one authority are as follows:

Size	Speed	
	0.80%C	0.15%C
No. 0 S. W. G.	104 ft.	115 ft.
3 S. W. G.	208 ft.	250 ft.
7 S. W. G.	250 ft.	345 ft.

In drawing rods or bars of such material as high speed steel the speed may be as low as 10 feet per minute, while fine copper wire may reach a drawing speed of nearly 1000 feet per minute in continuous machines.

In mild steel bars, drawn on a rack from ½ inch diameter and upwards, it is usual to reduce that diameter by 1-16 of an inch, for smaller sizes 1-32 of an inch; but in drawing some of the very large sizes, such as 3 inches and upward, a reduction as high as ⅛ of an inch can be obtained.

All the above reductions are for steel containing not more than 0.15% carbon. As a rule, bars over 3½ inch diameter are more profitably made by turning than drawing.

Modification of The Physical Properties of Steel When Drawn

The most pronounced effect of cold drawing is the remark-

(*Continued on page 404*)

Spool-less Stitching Wire

By J. B. Green, M. E.

Research Dept. Chicago Steel & Wire Co.

THE name "Spooless" was devised by the author of this article in 1914 to describe a system of winding Boxmakers' and Bookbinders' stitching wire for the purpose of doing away with the returnable spools then in universal use in this country. Soon after such wire was introduced to the trade by the Chicago Steel & Wire Co. other manufacturers began putting out their product in similar form and the term "spooless" began to come into general use.

Later the author made numerous improvements finally adopting a paper shell or core to wind the wire on and such winding is now often referred to as "on cores" to distinguish it from the "on spools" winding formerly used. It is now customary for all stitching wire manufacturers to supply their product either "on cores" or "on spools" according to the buyer's preference.

For one reason or another various manufacturers adopted different dimensions for the holders required to use the wire on cores. More recently the benefits of standardization have been appreciated. The author and others have transferred their patents to the Mossberg Pressed Steel Company, who now manufacture standard holders for the entire industry. There are two sizes known as 5 lb. and 10 lb. Coils of spooless stitching wire are mounted on standard holders such as the Mossberg Standard Holder. One holder is required for each stitching head operated. The coil of wire wound on the core is placed on the hub of the holder, the detachable flange screwed tightly in place, the tie wires then cut but not necessarily pulled out and the substantial equivalent of wire wound on a spool results.

The industry as a whole has had released several hundred thousand dollars of capital through the use of spooless wire which otherwise would be required to carry the investment in full and empty spools. In addition the users' operating costs are reduced by the elimination of the returnable spools. Freight and cartage must be paid both ways on spools which represent, with the added weight of the packing case, about 25% of the total. The average life of the returnable spool has been found to be about four years, which means that the industry would have to shoulder an expense of probably $40,000 to $50,000 a year in broken and lost spools if spooless wire were not so generally used. Practically all this loss would fall on the user.

Sleeper & Hartley TRADE MARK

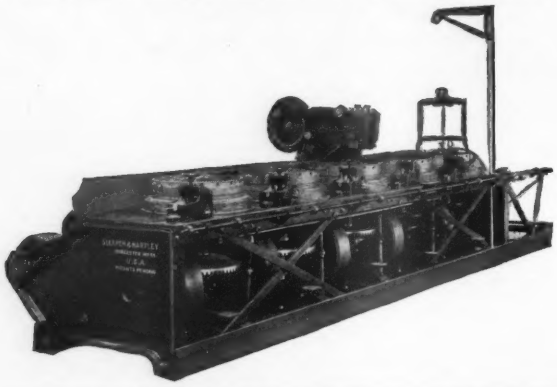
Practical Continuous Wire

These Machines Go Into Production at the—R

Rod Frame

(No. 5—14 or 15 wire)
Patented June 3, 1924—May 12, 1925—others pending

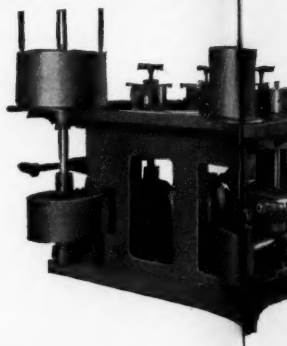
All Ball or Roller Bearings
No Differential Gearing.
Automatic Compensation for Speeds of Heads.



Double 5-Draft

No. 14 to No. 23.
3 to 4 Blocks
No. 14 to 19—4
No. 14 to 20—5

More than 250 heads of this



WIRE MILL EQUIPMENT

TINNING AND GALVANIZING FRAMES AND WIPERS

PATENTING FURNACE TAKE-UPS

WIRE POINTERS. WIRE PULLERS

WIRE SPOOLING DEVICES

MULTI-HEAD WIRE STRAIGHTENING AND CUTTING MACHINES

WIRE TWISTING AND STRANDING MACHINES

AGENTS: CHICAGO TERRITORY,
Neff, Kohlbusch & Bissell, Inc.

SLEEPER &

FOREIGN AGENTS AND REPRESENTATIVES: UNITED KINGDOM—Mr. Fredk. A. Perry, 63 Queen Victoria St., London. E. C. 4. FRANCE—Mr. Edgar Bloxham, 12 Rue du Delta, Paris. BELGIUM—Isbecque, Todd & Cie., 25-27 Boul. Emile Bockstael, Brussels.

WORCESTER

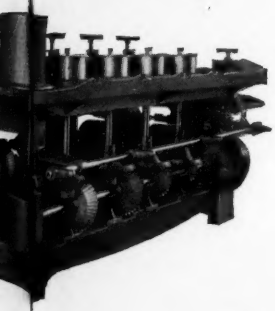
Wire Drawing Machinery

Sleeper & Hartley TRADE MARK

at Re—Reducing Overhead-Increasing Production!!

aftry, Intermediate

3. or low carbon wire.
ks to erage Operator.
-4 ho 400 lbs. per block.
-5 ho 1100 lbs. per block.
f this proved model in operation

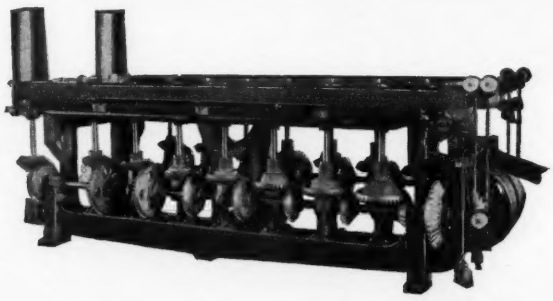


Double 8-Draft Fine Wire: Wet

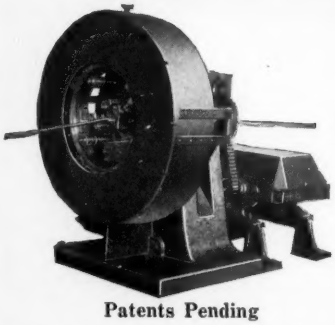
No. 22 to 36. High or low carbon wire.

6 Blocks to Average Operator, 22-33, 8-hole, 660 lbs. per day of ten hours.

Many thousands of these heads in operation



ARMORING MACHINES FOR "BX," PARK CABLE MOTOR WIRES, HOSE Etc., Etc.



Patents Pending

High Productive Speeds

LOCK WASHER MACHINERY

with Enormous Output

HIGH SPEED STRANDING MACHINERY

ARTLEY, Inc.

Agents: Philadelphia Territory
Swind Machinery Co.

ITALY—Henry Coe & Clerici, Milan. AUSTRALIA AND NEW ZEALAND—Edwin Wood Pty., Ltd., Melbourne.
JAPAN—Andrews & George Co., Tokyo. SWEDEN AN D FINLAND—Akt., Rylander & Asplunds, Stockholm.

ERMASS., U. S. A.

The Foreign Machinery Market

By Max Irmischer

TECHNOLOGY is making big strides ahead. Competition is growing keener and keener, and even old-fashioned firms are compelled to improve their production methods by installing new and better machinery.

It should be one of the first steps of the wire manufacturer or former who contemplates the purchase of new, or the replacement of old equipment to obtain reliable information concerning the latest developments on the machinery market. Of course it will not suffice to merely consider domestic products. A bird's eye view of the world market, that is what the drawer and former needs and what he can demand before he places his order. Inquiries lodged with the leading firms in the various machinery producing countries usually procure enough informative literature to enable our manufacturers to decide upon the most advantageous equipment for their particular purposes.

Ways of Securing Quotations

It is today relatively easy to avail oneself of offerings and price quotations from all countries as well developed international trade relations facilitate quick communication and smooth and frictionless transactions. It is in this connection that we wish to call attention to the WORLD INDUSTRY INDEX and the various export and import journals which are published all over the globe. The American representatives—consuls and trade commissioners—of machinery producing countries, such as England, France, and Germany, too, are always willing to supply names and addresses of foreign producers. The information bureau of the LEIPZIG TRADE FAIR, Leipzig, Germany, too, has rendered efficient services in this direction. The expenses attached to such inquiries are but nominal and should not detain interested circles. Such preliminary investigations not only enable the potential buyer to make a thorough survey of the prevailing market conditions and a comparative study of the products of the various countries, but may also result in immediate advantages countable in dollars and cents.

International Business

International business can be transacted in three different ways:

(1). The prospective buyer inquires of a firm abroad, and the latter submits a direct offer, quoting either factory or f.o.b. prices. In such a case, it is up to the inquiring firm to obtain information as to freight rates, custom duties, broker fees, etc., which are essential in calculating the total cost of the machinery. Before consummating the sale, however, the ordering firm should orient itself as to the credit and reputation of the concern with which they wish to place their order. Such confidential information is gladly given by the American Consul of the country in which the firm operates. The customary terms for such transactions are: one-third with order, and the remaining two-thirds on bill of loading. This arrangement may be modified upon agreement of the parties involved. Actual shipment, custom house clearance, and inland transportation have to be taken care of by the buyer.

(2). The foreign manufacturer may submit his offer

(*Continued on page 396*)

NEWS OF THE INDUSTRY

Research in Industry

Edward J. Mahren, vice-president of the McGraw Hill Publishing Company, returning recently from several months spent abroad in studing economic conditions, cautioned America that if she was to successfully cope with Germany's mass production she must also duplicate Germany's methods of intensive industrial research. He said:

"In the way of recovery, Germany's progress has been especially noteworthy. There is an enthusiasm, an intelligence and an energy among her industrial leaders that is astonishing and inspiring. Every means for reducing production costs is being intensively studied. Her handicape will prevent her from being at once as formidable a rival in foreign trade as she was before the war, but eventually her ability to produce cheaply and well will challenge the industrial genius of every other land. We in America can hold our place in the future competition with her only by the same means she is employing—hard work, and thorough and extensive scientific and industrial research.

Members of the Manufacturers' Association of Connecticut have at their disposal a Research Department which, working through Yale University, can help them to solve their problem regardless of what department of engineering it may fall under. Many members are making use of this service, but there are many who have need of it, the Research Committee feels sure, but who have not realized that they could be helped by the Association. The Committee hopes that members who have been served will make a point of telling others.

New England Fair

Among the features at the New England Fair was the 7000 pound Morgan Connor wire machine. The machine was run at one-half speed so that all operations could be observed.

The Parker Wire Goods Co. showed a machine that fabricates universal chain with a uniform diameter on all sides. The chain is in reality similar to a wire rope of many strands and is used for carrying light loads through pulleys.

A survey conducted by the U. S. Dept. of Commerce and the New England Council shows that of the nation's wire industry and closely related industries 16 are located in New England. There are 9 in Massachusetts, six in Connecticut and 1 in Rhode Island.

The Belden Mfg. Co., 2300 Western Avenue, Chicago, manufacturer of electric wire and cables, magnet wire, etc., has tentative plans under way for an addition to its plant at Richmond, Ind., to cost in excess of $50,000 with equipment. John W. Mueller, First National Bank Building, Richmond, is architect.

The Stamford Mills, Inc., Springdale, Conn., manufacturer of brass goods, has awarded a general contract to the Bray Co., 62 Cannon St., Bridgeport, Conn., for a one-story adition, 112x215 ft., to cost in excess of $75,000 with equipment. It will replace a portion of the plant recently destroyed by fire. Fletcher-Thompson, Inc., 542 Fairfield Avenue, Bridgeport, is architect and engineer.

The Higgins Brass Mfg. 12435 Dequindre Street, Detroit, is completing plans for a one-story addition, 80x200 ft. to cost close to $75,000 with equipment. G. V. Pottle, David Whitney Building, is architect.

The Rome (N. Y.) Wire Company, producing an extensive line of wire for the automobile industry, is operating plants at Rome and Buffalo at top speed. The company has just been informed that it has won its case regarding bonuses paid officials in 1917 under a decision handed down by the United States Board of Tax Appeals at Washington. The deficiency in tax payments was claimed by the commissioner of internal revenue, who refused to allow a deduction for the officials' bonuses.

Domestic Exports of Iron and Steel Wire, Wire Rope and Nails, From the United States, By Countries

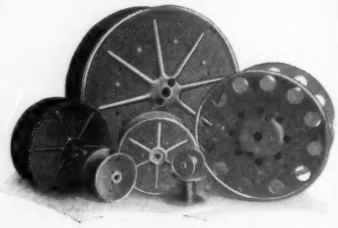
August, 1927

Countries	Plain iron or steel wire	Galvanized wire	Barbed wire	Wire rope	Insulated iron or steel wire and cable	Wire nails
	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
Azores & Maderia Is.	.....	.....	.....	.....	.....	450
France	.....	.....	.....	7,670	.....	.....
Germany	6,780	.....	.....	.....	.....	.....
Norway	7,300	.....	.....	.....	.....	.....
Portugal	.....	.....	.....	.....	.....	2,000
S. Russia in E.	.....	.....	.....	.....	5,190	.....
Spain	.....	14,672	.....	.....	.....	.....
Sweden	.....	.....	.....	1,554	.....	.....
United Kingdom	44,969	49,128	.....	315	.....	4,480
Canada	765,071	657,163	447,282	79,831	100,792	7,054
B. Honduras	.....	200	400	.....	.....	1,200
Costa Rica	.....	.....	35,800	412	.....	17,280
Guatemala	5,232	2,200	184,100	2,132	.....	34,039
Honduras	2,039	750	42,800	7,005	.....	40,465
Nicaragua	560	2,347	81,580	1,691	.....	47,052
Panama	1,035	73,397	53,000	53,645	6,636	138,794
Salvador	.....	.....	126,673	.....	.....	.....
Mexico	439,314	274,964	881,915	82,397	17,588	20,209
Miquelon & St. Pierre Is.	.....	.....	.....	.....	.....	3,022
Newfoundland & Lbr.	755	.....	.....	5,745	.....	2,200
Bermuda	.....	.....	.....	.....	3,019	8,570
Barbados	.....	.....	39,750	341	.....	8,700
Jamaica	.....	862	.....	312	2,388	6,700
Trinidad & Tobago	.....	.....	.....	3,268	.....	20
Other B. W. Indies	550	5,399	1,332	1,783	.....	14,814
Cuba	33,778	88,196	1,519,090	65,056	4,946	615,721
Dominican Rep.	356	3,961	181,780	6,717	1,052	79,796
D. W. Indies	.....	.....	300	8,019	.....	9,295
Haitian Rep.	900	4,225	20,200	.....	.....	13,000
Virgin Is. of U. S.	.....	.....	6,000	.....	.....	2,721
Argentina	260	1,289,734	740,337	102,126	.....	.....
Bolivia	.....	.....	.....	3,292	.....	.....
Brazil	99,647	41,055	3,445,306	7,307	.....	2,176
Chile	12,620	3,840	38,581	27,165	.....	53,205
Colombia	164,337	78,825	1,641,150	1,918	400	145,257
Ecuador	.....	.....	40,000	.....	.....	36,000
D. Guiana	.....	.....	40,000	.....	.....	36,000
Paraguay	.....	.....	.....	.....	.....	3,527
Peru	50,483	20,612	106,403	34,038	.....	108,826
Uruguay	.....	.....	36,376	710	.....	.....
Venezuela	.....	1,578	186,022	20,059	.....	16,426
B. India	.....	.....	.....	4,645	.....	.....
B. Malaya	.....	.....	.....	7,045	.....	.....
Java & Madura	15,239	.....	.....	.....	.....	.....
Other D. E. Indies	.....	.....	215,980	107,426	.....	.....
French Indo-China	.....	.....	180,226	31,912	250	.....
Japan, inc. Chosen	4,565	113,420	199,718	9,585	2,863	14,029
Kwantung leased Ter.	.....	151,035	.....	.....	.....	.....
Philippine Is.	.....	29,722	35,750	70,614	.....	154,000
Siam	.....	.....	.....	1,541	.....	.....
Australia	384,184	.....	77,586	.....	445	842
B. Oceania	.....	.....	.....	.....	.....	4,925
F. Oceania	2,640	149	.....	.....	.....	800
N. Zealand	.....	18,728	6,900	276	.....	3,357
B. S. Africa	100	153,835	250,300	.....	120	1,075
Egypt	.....	.....	810	.....	.....	.....
Portuguese E. Africa	.....	.....	101,000	.....	.....	.....
Other Portuguese Africa	.....	.....	.....	.....	.....	600
Total Quantities	**2,043,815**	**3,079,997**	**10,927,947**	**757,552**	**145,689**	**1,629,727**
Total Values	**99,476**	**90,478**	**311,614**	**102,358**	**30,422**	**53,161**

Shipments from the United States to Non-Contiguous Territories.

	6083 Wire Pounds	Dollars	6092 Wire Nails Pounds	Dollars
Alaska	183,730	23,127	124,497	5,821
Hawaii	366,449	30,138	141,267	5,203
Porto Rico	310,382	22,802	116,026	5,244

A Quarter Century of Experience in Adapting Steel Reels and Spools for the Wire Maker



Originators and first manufacturers of steel reels and spools for use in handling wire, Mossberg experts are often able to solve your shipping or production problems for you. Their wide experience is at your service.

APCO-MOSSBERG CORPORATION

13 Lamb Street

Attleboro, Mass.

Specialists in development of steel reels for annealing, vulcanizing and stranding; also bobbins for wire weaving.

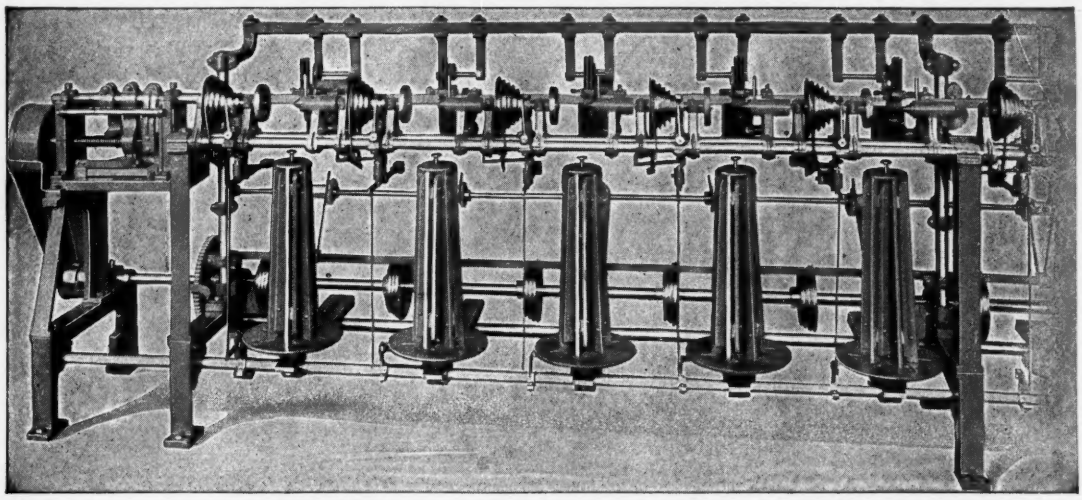
Domestic Exports of Iron and Steel Wire Manufactures, Horseshoe Nails and Horseshoes From the United States, By Countries

August, 1927

Countries	Woven wire fencing	Wire cloth & screening		Wire n. e. s. & manufactures of	Horseshoe nails	Horseshoes
	Pounds	Pounds	Dollars	Pounds	Pounds	Pounds
Belgium	.....	1,275	225	3,040	2,200	.....
Denmark & Faroe Is.	.....	.....	.....	2,488	.....	.....
France	.....	315	101	2,022	.....	.....
Germany	.....	.....	.....	676	2,260	.....
Greece	.....	.....	.....	1,660	.....	.....
Irish Free State	32,778	44	33	.....	.....	.....
Italy	.....	.....	.....	340	.....	.....
Netherlands	1,168	.....	.....	680	6,005	.....
Norway	.....	266	32	6,782	.....	.....
Poland & Danzig	.....	.....	.....	16,020	.....	.....
Sov. Russ. in Eur.	.....	.....	.....	782	.....	.....
Spain	.....	.....	.....	141	.....	.....
Sweden	.....	.....	.....	1,176	.....	.....
Switzerland	.....	.....	.....	.....	3,619	.....
United Kingdom	156,496	50	23	157,735	560	.....
Canada	87,022	90,502	25,432	305,153	.....	56,381
Brit. Honduras	1,071	.....	.....	244	.....	.....
Costa Rica	2,213	1,020	191	938	1,600	9,400
Guatemala	294	1,809	298	380	3,750	.....
Honduras	2,518	2,210	258	2,461	.....	200
Nicaragua	410	1,604	294	3,600	.....	.....
Panama	18,456	4,086	567	7,727	100	.....
Salvador	.....	.....	.....	1,059	.....	.....
Mexico	39,490	38,224	6,565	287,308	58,862	20,418
Newfld. & Labr.	.....	.....	.....	5,446	.....	.....
Bermuda	807	325	54	1,566	80	600
Jamaica	2,582	1,972	183	8,597	.....	.....
Trinidad & Tobago	1,526	753	77	776	.....	2,000
Other Br. West In.	1,896	10,430	956	698	.....	100
Cuba	203,462	36,879	5,030	65,053	54,570	600
Dom. Republic	1,390	10,098	810	6,177	.....	100
Dutch West In.	14,373	.....	.....	142	.....	.....
Haitian Republic	5,066	966	159	1,685	.....	.....
Argentina	5,239	86,804	6,240	21,743	40,511	.....
Bolivia	.....	891	201	1,015	.....	.....
Brazil	235	2,105	259	158,355	.....	.....
Chile	1,110	7,334	1,235	47,349	11,460	1,600
Colombia	1,853	5,455	1,208	16,199	14,105	.....
Ecuador	.....	4,853	688	.....	1,500	.....
Brit. Guiana	.....	392	136	38	.....	.....
Dutch Guiana	.....	875	170	170	.....	.....
Paraguay	5,334	.....	.....	.....	.....	.....
Peru	.....	2,085	237	9,068	4,100	2,213
Uruguay	1,352	7,725	1,230	1,102	.....	.....
Venezuela	21,386	9,935	1,468	16,321	1,250	.....
Brit. India	32,423	.....	.....	87,062	5,380	.....
Brit. Malaya	.....	782	177	573	.....	.....
China	.....	3,722	1,191	23,349	4,130	.....
Java & Madura	13,174	.....	.....	780	.....	.....
Other Dutch East In.	813	.....	.....	64	.....	.....
Hongkong	.....	.....	.....	282	.....	.....
Japan, inc. Chosen	98	7,808	1,546	167,623	10,000	.....
Kwangtung	.....	1,285	407	.....	.....	.....
Philippine Is.	88,323	13,077	3,427	6,236	12,415	38,520
Australia	1,300	61,337	11,317	105,754	6,555	36,960
Brit. Oceania	.....	935	192	.....	.....	.....
French Oceania	.....	546	32	.....	.....	.....
New Zealand	.....	1,262	237	13,470	1,775	.....
Brit. South Afr.	.....	25,255	5,440	3,639	.....	.....
Egypt	862	.....	.....	.....	.....	.....
Port. East Afr.	.....	617	116	338	.....	.....
Canary Islands	134	.....	.....	.....	.....	.....
Total Quantit.	**746,654**	**447,908**	.....	**1,573,082**	**246,787**	**169,092**
Total Values	**37,543**	.....	**78,442**	**154,189**	**24,828**	**10,870**

European Wire Production Allocated

THE members of the International Wire Cartel, consisting of representatives of French, German, Belgian, Luxemburg and Czechoslovakia producers, recently met in Brussels to draw up definite decisions. They made the following allocations of production: Germany, 1,000,000 tons; France, 400,000 tons; Belgium, 280,000 tons; Luxemburg, 120,000 tons. The allocation for the Sarre is contained partly in that of Germany and partly in that of France. With regard to the proposal for the formation of a wire-drawing cartel, it is untrue to say that it came to nothing. On the contrary, negotiations are still under way, and a further meeting is shortly to be held in Brussels.



KOEGEL FINE WIRE SPOOLING MACHINE FOR SPOOLS UP TO 6" DIAMETER, STANDARD MACHINE FROM FOUR TO TWELVE HEADS. CAN FURNISH WITH ANY DESIRED NUMBER OF HEADS.

Above illustration shows our improved type of fine wire spooling machine. This machine has some very important features, for example, the head sections are so designed that no spool spindles are required, and this, we believe, is a very good time saver which all manufacturers will appreciate. Another feature is that the swifts or blades are located underneath the machine, and directly in front of the operator, thereby making it very convenient for the operator when filling the swifts or blades with bundles of wire. Write us for further details about this machine.

Wire Spooling and Winding Machines of Every Description

CHAS. KOEGEL'S SONS, INC.

Holyoke, Mass.

World's Largest Cableway Across Nile

IT has just been announced that John E. Henderson and Company, a well-known engineering firm of Aberdeen, Scotland, is constructing what will be the world's largest cable way. It is to be used for the building of the Nag Hamadi dam over the Nile, and will have a span of 3,100 feet, involving the use of 22½ miles of steel wire rope. of 22½ miles of steel wire rope, capable of carrying five tons at a hoisting speed of 1,250 feet per minute. The height of the masts supporting the cableway will be 182 feet. The largest spanned aerial at present is that at Bradford waterworks, England, which 2,060 feet in length.

Electrically Welded Wire Fabric Used In Reinforcing Floor of Largest Outdoor Swimming Pool In the World

SAN FRANCISCO has the distinction of possessing the largest outdoor swimming pool in the world. It is called the Municipal Swimming Pool and is 1000 feet in length and 100 feet wide except for a center portion which measures 150 feet across.

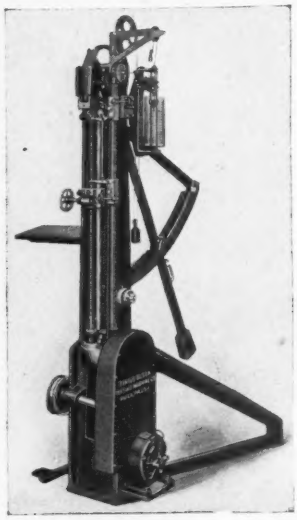
The floor slab is 5 inches thick which is 4½ inches structurally and ½ inch cement finish on the inside. The steel reinforcement used in the floor slab consists of No. 4 by No. 4 by No. 4 electrically welded wire fabric placed three inches from the top of the finished concrete floor.

The bottom of the immense tank is interlaced with expansion seams running longitudinally and transversely, the longitudinal seams being 42 feet apart. These expansion seams rest on 5 inch reinforced concrete footing 3 feet wide. This footing has been given sidewalk finish and painted with coal tar to permit possible bond between the floor slab and footing, thereby making expansion possible without disruption to either floor slab or footing. The expansion joints are calked with one-inch spun oakum.

Olsen Vertical Autographic Pendulum Type

WIRE TESTER

Made in capacities from 50 lbs. to 1000 lbs.



This illustration is of the very latest up-to-date Autographic Wire Tester which will scribe the stress strain diagram on square cross-section paper, correcting for the sine angle of the pendulum to magnify the elongation of the wire ten times. The autographic record may be taken directly from the wire, and thus the greatest of accuracy secured in such a record, as we do not consider any autographic record or wire test as satisfactory or acceptable taken from the motion of the heads of the testing machine.

Olsen Autographic Wire Testers can also be secured of capacities from 10,000 lbs. up to 1,000,000 lbs. capacity for testing steel, copper or brass wire of all gauges, as well as the largest wire rope made.

Also manufacturers of Olsen Static-Dynamic Balancing Machine equipment for balancing high speed rotating parts, which will eliminate vibration and increase efficiency and production of all high speed machinery.

Manufactured by

TINIUS OLSEN TESTING MACHINE CO.

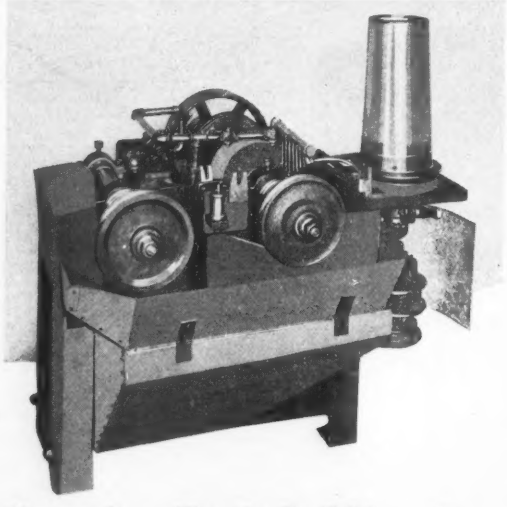
500 North 12th St., Philadelphia, Pa.

NEW IMPROVED TYPE

Superior Wire Drawing Machine

An 8 draft continuous machine for copper or steel wire.
Clutch action on spindel and main drive.
All gears are enclosed in an oil tight case.
Ball bearings throughout.

Designers and Builders of Wire Drawing and Special Machinery



The Superior Tool & Mfg. Co.

172 Union St. **Worcester, Mass.**

The Foreign Machinery Market

(*Continued from page 392*)

through his U. S. A. representative. It is understood that such representative is entitled to a commission which is contained in the quoted net price. It should be kept in mind, however, that the American buyer does not deal *with* the representing individual as such, but *through* him with the firm abroad. Transportation and delivery is to take place as described in the foregoing paragraph.

(3). The firm abroad answers the prospective buyer that they have an authorized agent in his country, and that this agent will get in direct touch with him. Such an agent often carries the name of the firm whose products he handles, and should be considered as a sort of branch office of the foreign manufacturer. He usually conducts his business in close cooperation with the manufacturing exporter. It sometimes happens that the agency deals with several manufacturers of kindred products in order to reduce overhead expenses. These agencies are well familiar with the industrial situation of the countries from which they import, and are in a position to submit binding price quotations including freight, duty, and inland transportation rates.

Before placing his order, the potential buyer is entitled to a consultation of a mechanical engineer who discusses with him all technical problems involved. The latter sees to it that all specifications are properly entered, and that the type of machinery ordered is best adapted for the requirements of the client in question. If, upon delivery, disturbances should occur, the agency will assign a special engineer to adjust the matter without delay. The "service" of any up-to-date agency equals that of any domestic manufacturer.

The agent usually is on a long time contract basis with forwarder.

An agent, although he may sometimes receive subsidies from exporting manufacturers, is legally an independent firm, liable under the laws of the State in which he is registered, that is to say, the purchaser does not deal with a foreign manufacturer, but with a domestic firm. Broadly speaking, they consider themselves as commissioned by the domestic drawer and former to locate for him the markets where he may buy his machinery most advantageously.

Patent Pools and Anti-Trust Laws

(*Continued from page 387*)

agreements give an impetus to further invention. Every company is anxious to have the distinction that its product is first to embody the latest improvememts in the industry. The automobile industry has found from its experience that for various reasons, such as the scepticism of other members with reference to the value of new patents, the company which secures a patent and applies it immediately to the betterment of its product has at least a year's start over its competitors.

A patent, owned or controlled by one member of an industry may be useless in itself, yet extremely valuable when combined in use with other patents owned by his competitors. By breaking up what has been aptly termed the "congestion of patents", every patent owner is free to improve his product. Without the privilege of making use of the numerous improvement patents, the patentee finds himself in the position of the owner of a key plot who must pay a stipend to assemble contiguous plottage.

Again, the psychological factor in industry is extremely improved when its members can feel that they are united with a single purpose of bettering their product through the common utilization of technical knowledge.

URDIKA

ELMARID

The most improved metal composition die.

Manufactured in sizes ranging from .020" to .300"

STEEL SET

DIAMOND DIES

Highest Quality

Accurate Size Smooth Draw

URDIKA

WIRE DIE WORKS

105-107 Fulton Street New York City

The knowledge of manufacturing licensees under patent pool agreements that they have protected themselves against infringement suits permits each manufacturer to devote his energies to the development of a better and cheaper product, make further investments for improvement of his plant, and promote sales.

The Anti-Trust Laws and Patent Rights

Since the Standard Oil and American Tobacco decisions and especially in view of the Cement and Maple Flooring cases, it has been definitely settled that only those contracts and combinations among competitive units are in violation of law that unreasonably and unduly restrain trade, and which are injurious to the public welfare. The statute is thus to be construed by the "rule of reason", as if the words "unduly" and "unreasonably" were incorporated into the statute. Restrictions and conditions in contracts and in combinations were reasonable, and therefore not violative of the statute, if they were usual and normal, and fostered and promoted, rather than destroyed and stifled, trade.

An extended citation of authority will but lead to generalizations far removed from an application to patent interchange. It is sufficient to indicate that the decided cases apply various legal tests. The chief factors thus far discussed by the courts involve the effect of the combination; its extent; its nature; the methods employed; the intent of the parties; and the particular facts in the industry.

Decisions Dealing With the Combination of Patent Rights

Bearing in mind the social utility of the mutual interchange of patent rights, and the reasons which created the necessity for such co-operative effort, we can proceed to examine the leading authorities.

One of the land-marks involving the relation of the patent law to the anti-trust laws, is the Bement case, affirmed in the General Electric case. The exact holding must be thoroughly

Are You Interested--

in installing a rolling mill with a fine wire drawing plant for phosphor - bronze, suitable for metal cloth used in paper manufacture, according to German practice.

If So--

COMMUNICATE WITH

W.W. I. "ADS" Actien-Gesellschaft
Berlin-Grunewald, Winklerstr. 11
Germany

A SCOTT TESTER

For Wire, Sheet Metals and Other Materials

A simple, practical recording tensile testing machine

Maximum Capacity 2000 lbs.

The test results are automatically recorded on standard letter size forms (8½x11 in.) The machine is easily handled; is safe and strong and free from delicate parts. Does not require a trained operator or technical man.

Manufactured By

Henry L. Scott Co.

101 Blackstone St., Providence, R. I.

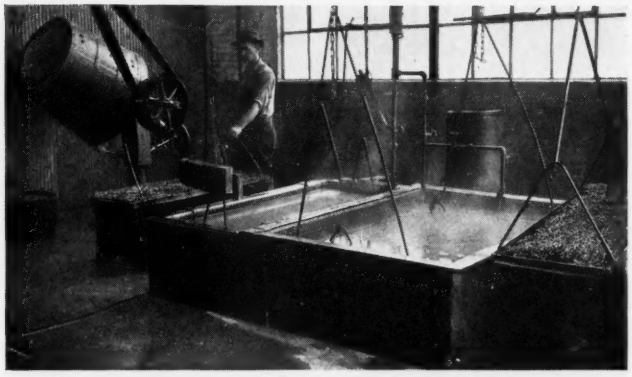
understood so that we may avoid the errors into which various courts have fallen, in purporting to follow the authority of this decision.

The importance of the Bement decision, from our point of view, lies in the announcement of the rule.

"But that statute (Sherman Anti-Trust law) clearly does not refer to that kind of a restraint of interstate commerce which may arise from reasonable and legal conditions imposed upon the assignee or licensee of a patent by the owner thereof, restricting the terms upon which the article may be used and the price to be demanded therefor. Such a construction of the act, we have no doubt, was never contemplated by its framers."

Also, although it is clear from the opinion that the problem goes no further than to consider the rights of an individual patentee, it is important, nevertheless, to recognize that the corporation was the owner, by assignment, of many patents.. We see here, therefore, the beginnings of the broad doctrine that agreements between patentees, reasonably necessary to protect them in the enjoyment of their rights, are not in conflict with the anti-trust laws.

The leading case, which foreshadowed the trend of future decisions is the Bathtub Case, Standard Sanitary Manufacturing Co. v. U. S. In that case the manufacturers of 85% of the enamel iron ware entered into an agreement whereby they received from the secretary of their Association, who had become the owner by assignment of the essential Arrott patent, licenses to use the invention in the production of their enamel ware. The agreements provided for the regulation of prices through the instrumentality of a price and schedule committee, fixing the preferential discounts, confining them to sales to jobbers only, authorizing rebates if the agreements should be faithfully observed, forbidding all sales to jobbers not in the combination,



Cleaning chains before electro-galvanizing

Uses Oakite for cleaning wire mesh

ONE manufacturer of wire and wire products uses Oakite materials and methods for removing oil and grease from wire mesh before galvanizing.

Only through the thoroughness of Oakite cleaning can this manufacturer be certain of getting the proper results in the subsequent operation---that is, an even, unblemished galvanize without trouble or wasted time and labor.

In every wire mill there is a well defined need for the efficiency and economy in cleaning that only Oakite materials can give. The introduction of this modern cleaning is a very simple matter, which one of our Service Men will gladly explain to you. Write us.

Oakite is manufactured only by
OAKITE PRODUCTS, INC., 52A Thames St., NEW YORK N. Y.
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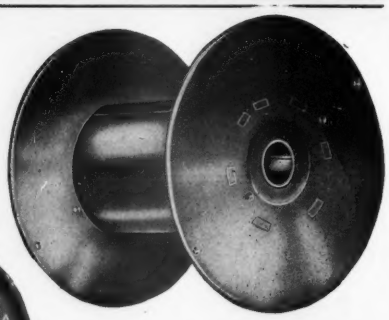

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making a condition of their entering, a promise not to sell to plumbers, except at prices determined by the manufacturers, and not to deal in the product of manufacturers not in the combination; and curtailing production by agreeing not to market so-called "B" or inferior products. It was contended by the defendant that this combination was necessary to protect the product of the industry, since the distribution of "seconds" and an inferior product defrauded the public, discredited the ware and demoralized the market.

This contention was answered by Justice McKenna:

"But the scheme has other features and effects which counsel overlook or ignore. It is immediately open to the criticism that its parts have no natural or necessary relation. What relation has the fixing of a price of the ware to the production of 'seconds'? . . . The agreements clearly, therefore, transcended what was necessary to protect the use of the patent or the monopoly which the law conferred upon it. They passed to the purpose and accomplished the restraint of trade condemned by the Sherman law. It had, therefore, a purpose and accomplished the result not shown in the Bement case. There was a contention in that case that the contract of the National Harrow Company with Bement Company with Bement & Sons was part of a contract and combination with many other companies and constituted a violation of the Sherman law, but the fact was not established, and the case was treated as one between the particular parties, the one granting and the other receiving the right to use a patented article with conditions suitable to protect such use and secure its benefits."

While the patent in this case was only on a tool which was employed in the manufacture of the enamel ware and the restrictive conditions set forth dealt with the unpatented ware, the court expressly refused to place its decision on so narrow a ground. It is to be noted that

in the court below, this consideration was deemed of vital importance. This cannot be held to be dictum in view of the plain holding of the court, but it must be observed that the rationale of the decision is broader than the facts warrant.

The Supreme Court further said:

"Rights conferred by patents are indeed very definite and extensive, but they do not give any more than other rights a universal license against positive prohibitions. The Sherman law is a limitation of rights,—rights which may be pushed to evil consequences, and therefore restrained."

Several questions involving the legal consequences of a combination of patentees have not yet been squarely determined by the Supreme Court. One involves the effect of an agreement among various patentees allowing a stated sum, jointly fixed, to be paid as royalties to a patentee, for the use of his invention. Another is the effect of arbitration clauses by which compensation for the use of patents is determined by arbitrators as each case arises. There is, however, the recorded authority of the Department of Justice, approving, as not violative of the anti-trust laws, such a clause, found in the Manufacturers' Aircraft Association agreements. The fundamental question of law reduces itself to the proposition that where the purpose and effect of such royalty agreements are merely to secure a fair and just compensation for the use of the patent and are not unduly restrictive of free competition, no violation of law occurs. If the royalty charged is small, in comparison with the total cost of the product, there does not seem to be a substantial relation between the royalty and the ultimate selling price. In other words, it is ordinarily too remote in the chain of causation to adjudge that the royalty, which is only a small fraction of the ultimate selling price, is to be deemed a controlling factor in a joint effort on the part of several patentees to

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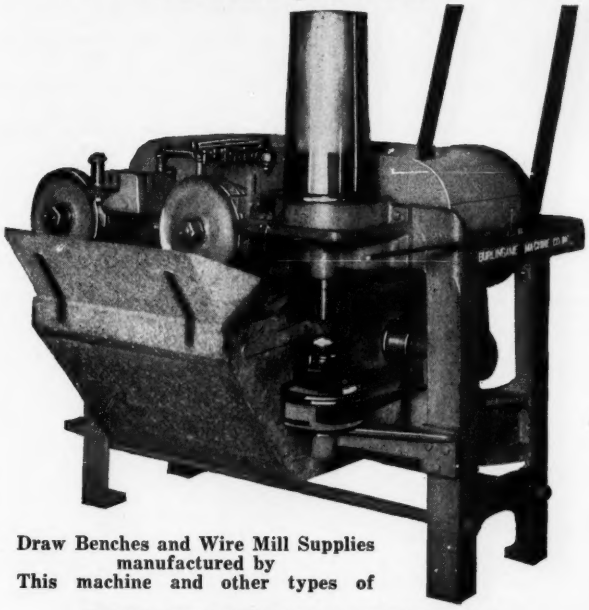

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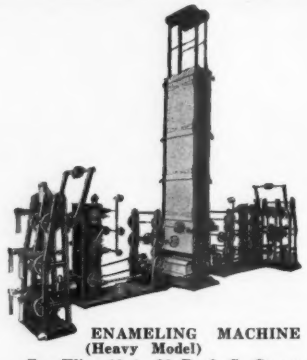

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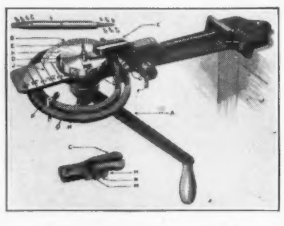

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regulate the price of their manufactured product.

The use of arbitration, with an impartial board of arbitrators, to place a fair estimate upon the value of numerous patents, each of which is used in the manufacture of the finished product, has been approved in principle and has been found practicable, in actual operation, in the aircraft industry.

Summary

In the last analysis, the anti-trust laws will best serve the purposes for which they were enacted, if they can succeed in preserving for the public the benefits of the growth and progress of American business, and in reducing to a minimum their attendant abuses.

These statutes are based upon the basic doctrine of the desirability of the maintenance of free and honest competition. The anti-trust laws have not condemned the principle of co-operation as such. Indeed, wherever co-operation has effected economy, advanced research or invention, improved the product, or fostered competition, it has received favorable recognition by the law.

Trade associations as such have now been recognized by the Supreme Court as having a legitimate scope in their joint efforts for the ends just enumerated, as well as in their credit bureau functions, standardization of products, collection and dissemination of statistical knowledge, and other legitimate activities which interest the industry at large. All these have been encouraged by legal approval.

Will the law accord the same measure of approval to patent interchange?

Viewing its underlying principle, we are led to the conclusion that it is nothing more than a scientific and intelligent co-operation of creative or inventive thought, much akin to a buraeu for scientific research. In principle, it is a democratization of ownership or interest in an original or creative idea, or group of ideas, a clearing house for the advancement of inventions. Indirectly, it is a dedication to so-

ciety of the aggregate of such scientific data.

Where the patent law would grant exclusive ownership in one, the patent pool extends it to many. That its tendency would be to improve or perfect the product can scarcely be doubted in theory. Experience has confirmed this view. Patent interchange tends likewise toward standardization of the product, reduced cost of production, elimination of the enormous waste of litigation and indeed yields, in short, the advantages to the public of a better commodity at a cheaper price. Again we are confronted with the dangers of abuse of concentrated power, either by joint price fixing, boycott against competitors, or other illegal restraints, by the combined patentees. There is ample power in the government to cope with such problems as they arise in a given case. The precedents of adjudging illegal the activities condemned in the Bathtub, the Addyston Pipe, and Hardwood cases, afford examples from the industrial history of the past. That patent co-operation is capable of abuse, is doubtless true, but this possibility is inherent in all joint effort. Where it is present, it can be detected and penalized in accordance to the provisions of the statutes.

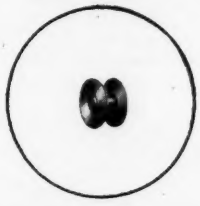
A plan which secures to the patentee a just compensation for his novel idea and bestows upon the public the benefits of progress serves a beneficial and commendable purpose. This underlying principle seems rather to be in harmony than in conflict with the anti-trust laws.

The Manufacture of Insulated Cable in France

(*Continued from page 385*)

There will be ionization by collision due to the impact of the ions upon the walls of the air pockets, and the kinetic energy of the ions will be changed to calorific or heat energy. In addition there will be produced

2½ INCHES *or* 8 FEET



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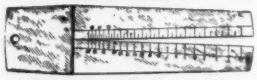
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some chemical phenomena, principally the formation of ozone which attacks the hydrocarbons thereby causing a more or less slow deterioration of the impregnating compound.

In the normal three-phase cable, the charring of the paper takes place in the central part of the cable.

On the other hand, if we trace the lines of heat flow when the cable is carrying current, (see fig. 10), we see that no heat lines start from the interior of the triangle ABC or in other words, one-sixth of the surface of the copper is not being cooled. If we picture the type of cable having equi-potential surfaces, in which each individually insulated conductor is covered with a layer of thin conducting metal tape, we can conceive how the electric field is radical with respect to each of the conductors and that the latter behave like three single conductor cables. Moreover, the heat radiated to the center of the cable by the copper conductor, is easily carried to the metallic layer over the insulation, and in turn is carried off toward the outside by means of the lead sheath.

In these cables, the outer insulation is omitted, and the metallic tape over the individually insulated conductors, is then in intimate contact with the lead sheath.

Drying and Impregnation

If we consider dry paper insulation without any impregnation, then the insulating resolves itself purely, into a mechanical problem, entailing particularly careful attention only to such requirements as uniformity, tightness, the manner of application of the papers, etc.

Before the lead covering operation, cables for power purposes are dried and impregnated. For this reason, the cables are placed in perforated baskets or pans, or even on metallic drums and sealed in large vats or tanks which are heated by steam. The drying is accomplished by means of vacuum produced by pumps with or without the use of condensers. The vacuum should be as perfect as possible.

When the drying operation has been completed, impregnating compound is introduced into the vat or tank, by means of vacuum, the object being to avoid the formation of any occluded air pockets. In order to produce a more thorough impregnation, air pressure is often resorted to, but when this is done, great care should be taken to avoid air bubbles and voids.

Fig. 12 shows a part of a drying and impregnating installation utilizing round pans in which the cables are placed. Certain tanks having a capacity of 35 cubic meters, accommodate two or three pans placed one on top of another, their total contents being from three to four kilometers of cable. This installation includes a series of pipe lines for steam, vacuum, compressed air and impregnating compound, the latter being capable of conveyance from one tank to the other by means of vacuum or air pressure.

Fig. 13 represents another type of tank used in conjunction with the iron drums carrying cable to be impregnated. In this system, the drum can be rotated by external means, during the impregnating operations.

(*To be continued*)

Some Important Factors in Wiredrawing

(*Continued from page 389*)

able increase in tensile strength and the corresponding decrease in ductility as measured by the percentage elongation in a tensile test.

A diagram is shown in Fig. 17 of mild steel wire, giving the number of passes, the size, the tensile strength and the percentage elongation at each pass. These tests are from an average of a number of samples and clearly indicate how the ductility is reduced and the tenacity increased.

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Regarding the two curves shown in the diagram, it is quite possible by manipulating the wiredrawing methods, that is by giving lighter or heavier drafts, to vary the slope of the curves. There is, of course, a limit to the extent by which the drafting may be manipulated, because if an attempt is made to reduce the wire too much in a single pass the internal structure is broken up and the wire, if it does not actually fracture, becomes brittle.

In patented steel wire, that is steel wire with a percentage of carbon sufficient to form a sorbitic structure after suitable heat-treatment, the curves are somewhat different, the initial tensile strength, of course, being higher.

Below is given a typical analysis of patented steel wire and Fig. 3 shows curves giving the tensile strength and elongation for each pass.

Carbon	0.500
Graphite	nil
Silicon	0.110
Manganese	0.480
Sulphur	0.033
Phosphorus	0.014

New British Ropeway

(*Continued from page 382*)

Justice Sankey said if he thought the scheme would create a monopoly for all time he would have liked a longer time to consider it. But this could be provided against by inserting in the order a clause giving liberty to apply to the Court. The scheme was approved, subject to the conditions stated in the minute of the order. The decision was concurred in by Sir E. Tyndal Atkinson expressing a hope that no unnecessary obstacle would be placed on the working of the experiment.

Undoubtedly the construction of this system will constitute one of the most interesting engineering jobs ever undertaken in Great Britain in which the major part is played by wire rope.

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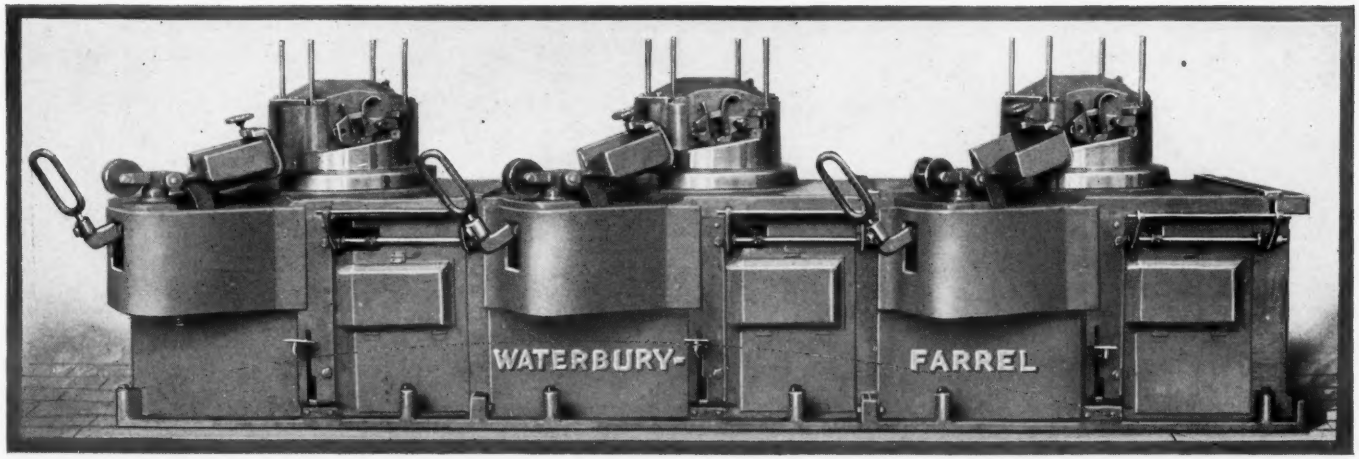

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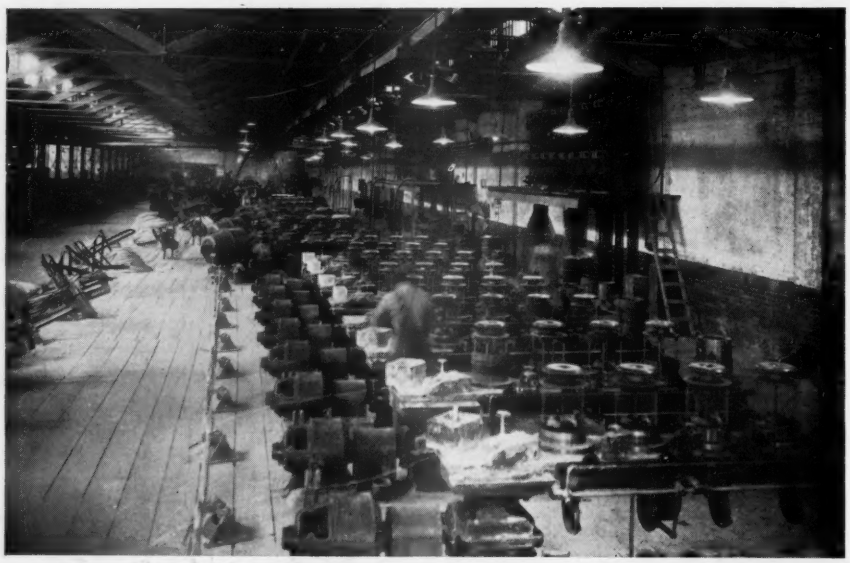
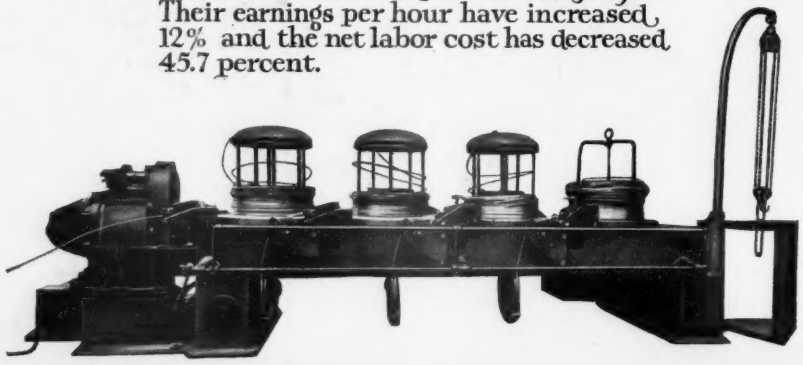
Western Sales Office: 1016 Williamson Building, Cleveland, Ohio.
Foreign Agencies: George H. Alexander, Birmingham, England. Etab. B. Gattegno, Paris, France.

MORGAN
WORCESTER
ENGINEERS AND MANUFACTURERS



Through this installation of
Morgan Connor Wire Machines
twelve men have replaced *twenty-eight.*
Their earnings per hour have increased
12% and the net labor cost has decreased
45.7 percent.



MORGAN CONSTRUCTION CO.
WORCESTER, MASSACHUSETTS, U.S.A.